COSEWIC
Assessment and Status Report

on the

Dun Skipper
Euphyes vestris vestris

in Canada

THREATENED
2013

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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COSEWIC
Assessment Summary

Assessment Summary – May 2013

Common name
Dun Skipper

Scientific name
Euphyes vestris vestris

Status
Threatened

Reason for designation
This species has a small population found in a restricted range in southwestern British Columbia, where it occurs in moist, open habitats, including meadows, wetlands, and disturbed sites. Meadows and wetlands are declining in area and quality owing to natural succession, residential and commercial development, and invasive plants. Disturbed sites are inherently ephemeral and rapidly becoming unsuitable due to native and invasive plant succession. This is a rare species, and despite significant search effort over the last decade, few new sites have been located.

Occurrence
British Columbia

Status history
Designated Threatened in November 2000. Status re-examined and confirmed in May 2013.

COSEWIC
Executive Summary

Dun Skipper
Euphyes vestris vestris

Wildlife Species Description and Significance

The Dun Skipper (*Euphyes vestris vestris*) is a small skipper (wingspan 23 – 32 mm) with uniform chocolate-brown wings with a purplish hue and tan fringes on the outer margins. Adults sit with their hindwings laid flat and their forewings held upright. The head and thorax of adults (both sexes) are yellowish-orange. Eggs are pale green, crescent-shaped, globular and smooth when first laid, but prior to hatching change to a reddish colour on top. Larvae have a shiny, pale green body with many fine, wavy, silvery lines. Pupae are various shades of yellow, brown and light green, with a blunt, ridged edge at one end. There are two subspecies of the Dun Skipper in Canada (*E. v. vestris* and *E. v. metacomet*). This status report addresses *E. v. vestris*, the western ranging subspecies.

Distribution

Globally, the Dun Skipper ranges from southwestern British Columbia south through the western portions of Washington State, Oregon and northern California. The Canadian range is restricted to the lowlands of the lower Fraser and Lillooet Rivers (mainland B.C.), the southern Gulf Islands, and southeastern Vancouver Island. On the mainland, the species ranges from Lillooet south and west through Boston Bar, Pemberton, Yale and Hope. In the Lower Mainland, it ranges as far north as Powell River on the Sunshine Coast. On Vancouver Island, it ranges from the Victoria area north to Courtenay and Comox; on the Gulf Islands its distribution includes Salt Spring, Denman and Hornby Islands. There are 209 records dating from 1902-2011.

Habitat

Dun Skippers occupy a variety of habitats, including open south to southwest, gentle slope exposures, open forest comprised of Douglas-fir with lowland forest components; below open, sparsely vegetated cliffs and hillsides comprised of Douglas-fir and Bigleaf Maple; open moist to dry meadows; open deciduous woods and areas adjacent to swamps and streams; disturbed sites including roadsides, railway right-of-ways, ditches and powerline right-of-ways; areas with spring floods, natural hot springs or seeps, and wet seasonally flooded stream banks.

The Dun Skipper's flight period coincides with the onset of the growth period of the species' host plants, known to be sedge and grass species, although specific host plant species in B.C. are unknown. In eastern North America, Dun Skipper larvae are known to feed upon Yellow Nut-grass, which is rare in B.C., and San Diego Sedge, which does not occur in B.C.

Biology

Mating and oviposition coincide with the flight season from late May through early August. Males perch approximately one metre from the ground and wait for receptive females. Females lay eggs singly on the host plant and the eggs hatch after approximately one week. Larvae begin feeding and eventually form tubular silk shelters (one larva per shelter), formed from two to four tied and rolled host plant leaves. Throughout winter months, larvae diapause within these tubular silken rolls, emerging the following spring. Pupation occurs within silken tubes, likely at the base of the host plants in spring.

Population Sizes and Trends

Information on populations in B.C. is sparse and there are minimal data that show population sizes or trends. However, by looking at encounter rates, habitat patch size, and the size of other skipper populations, defensible lower and upper limits of 1500 and 5000 mature individuals can be placed on overall population size.

There has been no detailed monitoring of populations, but knowledge of habitat threats and trends allows one to infer considerable loss of habitat over the next 10 years, reducing the number of known locations by as much as 60 percent. Offsetting this trend, there is a possibility that some new sites may be created through logging or other anthropogenic activities.

Threats and Limiting Factors

Threats to the Dun Skipper include: 1) habitat loss, degradation and fragmentation from land conversion and infilling of the open wet habitat and plant communities that occur throughout the Lower Mainland and southeastern Vancouver Island; 2) natural forest succession; 3) pesticide application to control European Gypsy Moth; and 4) climate change, primarily through increases in summer drought, potentially resulting in desynchronized larval and host plant phenology. Alternatively, climate change may increase precipitation although spring flooding may be detrimental to larval and pupal survival.

Based on the threat of habitat fragmentation and private land development (based on land ownership), there are approximately 51 locations (landowners) for the Dun Skipper (extant and extirpated). When only extant locations are considered (records from 2001 or later and surrounding habitat with little change), the number of locations is reduced to 28 (landowners). Of the 28 locations, at least three are threatened by land development within the next three years, and at least 14 are within artificially created habitats (e.g., roadside pull-outs, pipeline crossings, and recent clear-cuts) that are rapidly changing as a result of natural vegetative succession and are not expected to be present in 10 years. There is an inferred reduction in the number of mature individuals from ongoing habitat loss and fragmentation; probably > 30%, based on cumulative threats from development projects in the lower mainland (e.g., industrial park at one site) and vegetative succession (based on non-native and native plant growth) at sites on Vancouver Island and the mainland.

Protection, Status, and Ranks

The Dun Skipper is recorded from (a minimum of) 14 provincial Crown land parcels; 3 provincial parks (plus two unconfirmed historic records); 2 federal properties (Indian Reserves); and 23 sites on private lands (one private conservation area, 3 local government protected areas; and 19 private land sites). The Dun Skipper is listed as Threatened under the federal *Species at Risk Act* and has been recommended for listing as *Identified Wildlife* under the B.C. *Forest and Range Practices Act*, B.C. *Wildlife Act* and *Wildlife Amendment Act*. Sites (both current and historic) within provincial parks are protected by the provincial *Park Act* and *Ecological Reserves Act*. There is no legislation that protects Dun Skipper on private lands. All sites on Vancouver and Gulf Islands are on private land except three in provincial parks.

TECHNICAL SUMMARY

Euphyes vestris vestris
Dun Skipper *vestris* subspecies
Range of occurrence in Canada: British Columbia

Hespérie rurale de la sous-espèce *vestris*

Demographic Information

Generation time	1 yr
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Inferred decline due to habitat loss
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Not available; probably less than 20%
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Inferred reduction, unknown magnitude
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Inferred reduction from ongoing habitat loss and fragmentation; probably > 30%
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Inferred reduction based on wetland loss; fragmentation; and cumulative threats; probably >30%
Are the causes of the decline clearly reversible and understood and ceased?	No
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence 25,924 km^2 for the mainland and 6673 km^2 for Vancouver Island and Gulf Islands.	32,597 km^2
Index of area of occupancy (IAO) (Always report 2x2 grid value). This is the estimated extant IAO, based on known occurrence and expanded into known adjacent habitat. Actual IAO could be somewhat higher, but is most likely less than 500 km^2. Historical IAO: 280 km^2.	236 km^2
Is the total population severely fragmented?	Probably
Number of locations*	28 extant locations, based on potential of development as per land ownership as the primary threat
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Yes, based on habitat loss and fragmentation of wetland habitats

* See Definitions and Abbreviations on COSEWIC website and IUCN 2010 for more information on this term.

Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Yes, based on natural succession affecting 14 locations, habitat loss affecting 3 locations, and fragmentation of wetland habitats (most remaining locations)
Is there an [observed, inferred, or projected] continuing decline in number of populations?	Yes, based on habitat loss and fragmentation of wetland habitats
Is there an [observed, inferred, or projected] continuing decline in number of locations*?	Yes, based on habitat loss (3 of 28 locations) and fragmentation of wetland habitats; and vegetative succession (14 of 28 locations).
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes, based on habitat loss (3 of 28 locations) and fragmentation of wetland habitats; and vegetative succession (14 of 28 locations)
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Total (upper and lower limits inferred from encounter rates, likely number of populations, and habitat patch size)	1500-5000

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not done

Threats (actual or imminent, to populations or habitats)

The predominant threats are a combination of succession, invasive species (mainly Scotch Broom), and impacts of fire and fire suppression. Additional threats include agricultural land clearing, livestock grazing and application of Btk insecticide.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? S3 (Vulnerable) in Washington State	
Is immigration known or possible?	Unlikely
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada? Populations are limited by the availability of habitat	Unlikely
Is rescue from outside populations likely?	No

* See Definitions and Abbreviations on COSEWIC website and IUCN 2010 for more information on this term.

Status History

COSEWIC: Designated Threatened in November 2000. Status re-examined and confirmed in May 2013.

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Threatened	C1
Reason for Designation: This species has a small population found in a restricted range in southwestern British Columbia, where it occurs in moist, open habitats, including meadows, wetlands, and disturbed sites. Meadows and wetlands are declining in area and quality owing to natural succession, residential and commercial development, and invasive plants. Disturbed sites are inherently ephemeral and rapidly becoming unsuitable due to native and invasive plant succession. This is a rare species, and despite significant search effort over the last decade, few new sites have been located.	

Applicability of Criteria

Criterion A: Not applicable. Comes close to meeting Threatened under A3, since 30-60% of known sites are likely to become unsuitable over next 10 years due to natural succession, but it is unclear as to how many individuals these losses will represent. Some losses offset by new disturbance.
Criterion B: If species is considered severely fragmented, meets Endangered under B2ab(ii,iii,iv,v). However, it is unclear how many individuals belong to populations that could be considered non-viable; thus, severe fragmentation is difficult to prove.
Criterion C: Meets Threatened under C1; population estimated to be only 1500 to 5000 mature individuals. Decline in habitat over next 10 years will result in at least a 10% decline in mature individuals.
Criterion D: Does not meet criteria.
Criterion E: Not done.

PREFACE

There are two subspecies of the Dun Skipper in Canada, the western population being subspecies *Euphyes vestris vestris* and the eastern population being subspecies *E. v. metacomet*. The Dun Skipper (*E. v. vestris*) was assessed by COSEWIC in 2000 as Threatened. Since the first status report was prepared, new information on the distribution, habitat, habitat trends, threats and limiting factors has been gained through inventory and research by numerous private entomologists, government biologists and stewardship groups working within southeastern Vancouver Island, the Gulf Islands, and the southwestern mainland of British Columbia. At some of the former sites on Vancouver Island, the butterfly has not been recorded recently and there appears to be a general decline in habitat quality. Sites in the lower mainland are also declining in quality and quantity. Sites in the lower Fraser Valley appear to be less threatened, although when the loss of lower mainland sites are considered, the range is contracting toward this smaller area.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2013)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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Dun Skipper

Euphyes vestris vestris

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2013

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Scientific Name: *Euphyes vestris* (Boisduval 1852)

Classification:	Kingdom	Animalia
	Phylum	Arthropoda
	Class	Hexapoda
	Order	Lepidoptera
	Family	Hesperiidae
	Genus	Euphyes
	Species	E. vestris
	Subspecies	E. v. vestris

Synonyms:
The species was originally described by Boisduval (1852) as *Hesperia vestris*. Shepard (2000ab) states "several recent books give the species name as *Euphyes ruricola* (Boisduval). However, this name cannot be assigned to any known taxon and is a *nomen dubia* (MacNeil 1964; Brown and McGuire 1983)." Pelham (2008) lists the following synonyms: *Pamphila osceola* (Lintner 1898), *Euphyes osceola* (Lintner 1898), *Euphyes californica* (Mabille 1883), *Pamphila californica* (Mabille 1883) and *Hesperia vestris* Boisduval 1852.

Type Specimen:
The type locality is Spanish Ranch Road at Meadow Valley, 3600' (1100m), Plumas County, California (Emmel *et al.* 1998; Pelham 2008). The holotype is housed at The Natural History Museum, London, England.

English Names:
Dun Skipper (western population) (Shepard 2000ab), Western Dun Skipper (NatureServe 2011), Immaculate Skipper (associated with former name, *Hesperia vestris*) (Guppy and Shepard 2001). Sedge Witch and Dun Sedge Skipper refer to other subspecies of Dun Skipper.

French Names: Hespérie rurale.

Taxonomic Background and Similarities: Two Dun Skipper subspecies are known to occur in Canada: Dun Skipper (western population) (*Euphyes vestris vestris* Boisduval 1852) and Dun Skipper (eastern population) (*E. v. metacomet* T. Harris 1862) (Layberry *et al.* 1998; NatureServe 2011). Elsewhere in North America a third subspecies, *E. v. harbisoni* (Brown and McGuire 1983) occurs in southern California (NatureServe 2011; Warren *et al.* 2010) and a fourth, *E. v. kiowah* (Reakirt 1866) in southeast Wyoming, Colorado, New Mexico, Arizona and northwest Mexico (Warren *et al.* 2010) (see Global Distribution). According to C. Guppy (pers. comm. 2013), the Fraser Canyon and Vancouver Island populations are each morphologically distinctive, and may prove to be two new subspecies, separate from *E. v. vestris*. There has not been any taxonomic work to confirm this separation and the subspecies is treated as one taxonomic unit for the purposes of this status report.

Henceforth "Dun Skipper" refers to Dun Skipper (western population, *E. v. vestris*) unless stated otherwise.

Morphological Description

Adults

The Dun Skipper is a small, butterfly-like lepidopteran (wingspan 23 – 32 mm) with uniform chocolate brown-purplish wings and tan fringes at the outer wing margins (Figure 1 and 2). Females and males have slightly different markings on the wings: females have small white cloudy spots on both the forewing and hindwing dorsal surfaces, and the hindwing ventral surfaces have a pale purplish crescent. Males have a black stigma (scent scale patch) on the forewings, and the wing bases are darker. The head and thorax of adults (both sexes) is yellowish-orange (Guppy and Shepard 2001; Layberry *et al.* 1998).

Figure 1. Dun Skipper: adult male on Spreading Dogbane, July 1, 2009, adjacent to a gas pipeline right-of-way near Hope, B.C. Photograph by Denis Knopp.

Figure 2. Dun Skipper: adult male on Spreading Dogbane, July 7, 2010, adjacent to a gas pipeline right-of-way near Hope, B.C. Photograph by Denis Knopp.

Eggs

Eggs have not been observed in B.C. Based on observations of the eastern subspecies, eggs are pale green, globular, and smooth (Guppy and Shepard, 2001; Brown and McGuire 1983; Heitzman 1965). Prior to hatching, eggs become reddish (Pyle 2002; Guppy and Shepard 2001).

Larvae

Based on the eastern subspecies, larvae have a pale green and shiny body with many fine, wavy, silvery lines. A black to caramel coloured stripe surrounds the head and there is a brown longitudinal stripe on each side (Guppy and Shepard 2001; Layberry *et al.* 1998).

Pupae

Based on the eastern subspecies, pupae are various shades of yellow, brown and light green (eNature.com 2011).

Genetic Description

There have been no genetic studies to clarify the relationship between Dun Skipper subspecies. There are no genetic data pertaining to conservation significance among or within populations of the Dun Skipper in B.C.

Population Spatial Structure and Variability

No studies on population spatial structure and variability are available for the Dun Skipper in B.C.

Designatable Units

The Dun Skipper is restricted to a small region of southwestern British Columbia, and therefore consists of one designatable unit in Canada.

Special Significance

The Dun Skipper is used by conservation organizations to represent the importance of rare and endangered species throughout the southwestern portion of B.C. Conservation organizations such as Salt Spring Conservancy (R. Annschild 2010), Galiano Conservancy (S.A. Blanchette pers. comm. 2010; T. Crowe pers. comm. 2010), and Denman Island Conservancy (A. Fyson pers. comm. 2010) use Dun Skipper as a broad umbrella for protection of habitats associated with the species, when informing private landowners about stewardship opportunities.

There is no information that suggests that the Dun Skipper has an important cultural or economic role for First Nations people in the region.

DISTRIBUTION

Global Range

The Dun Skipper is at the northernmost extent of its global range in southwestern B.C. (Figure 3). The subspecies ranges southward into the Cascade Mountains in Washington State (NatureServe 2011), through western Oregon and into northern California (A. Warren pers. comm. 2010).

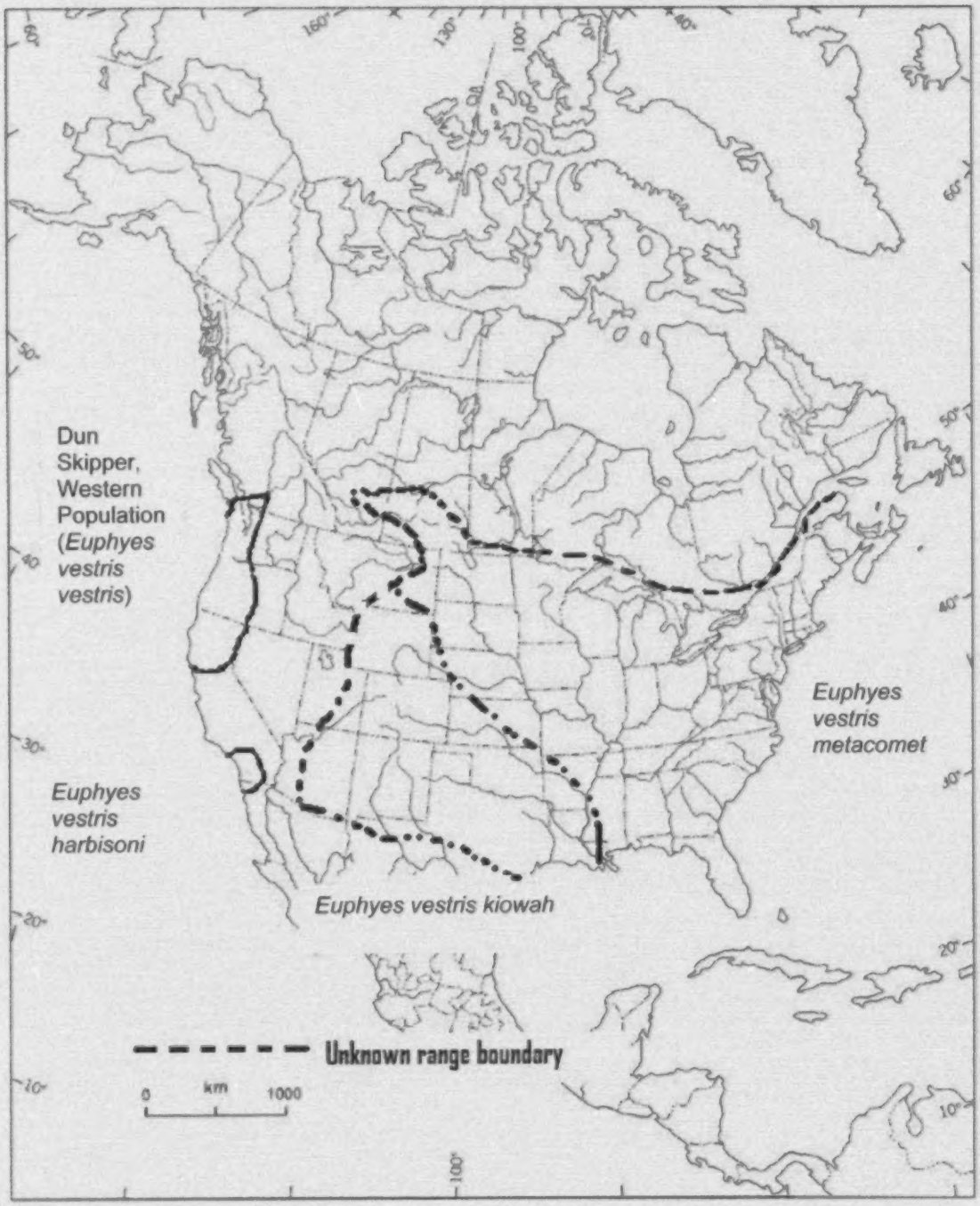

Figure 3. Global range of all Dun Skipper subspecies. Note the Dun Skipper (*Euphyes vestris vestris*) in western North America.

The North American range extent of other subspecies of the Dun Skipper is in question due to lack of distribution records and taxonomic uncertainty (Figure 3). The eastern population (*E. v. metacomet*) occurs from Alberta east through the southern parts of Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick, southeast through Montana, South Dakota, Kansas, Missouri, Arkansas, Mississippi and Louisiana, and eastward to the Atlantic coast (NatureServe 2011). A third subspecies, *E. v. kiowah* occurs throughout southeast Wyoming, Colorado, New Mexico, Arizona and northwest Mexico (Warren *et al.* 2010). The geographic separation between *E. v. metacomet* and *E. v. kiowah* is not known in detail (A. Warren, pers. comm. 2010). A fourth subspecies, *E. v. harbisoni,* occurs in southern California (C. Guppy pers. comm. 2011; NatureServe 2011; Warren *et al.* 2010) and has also been confirmed in extreme northern Baja (A. Warren pers. comm. 2010).

Canadian Range

The Canadian range of the Dun Skipper is well known. It is restricted to southwestern B.C. within the lowlands of the Fraser Valley and the Fraser Canyon, the southern Gulf Islands and southeastern Vancouver Island (Figure 4). On Vancouver Island, it ranges from the Victoria area north to Courtenay and Comox. Known Gulf Island sites include Salt Spring Island, Denman Island and Hornby Island. Along the Fraser River, it ranges from Lillooet south through Boston Bar, Yale and Hope and into the Lower Mainland at Agassiz, Chilliwack, and Burns Bog. North of the Fraser, it is known from Pemberton and Powell River. Based on known records, the historic and present (combined) extent of occurrence (EO) is 32,597 km^2 (25,924 km^2 for the mainland and 6673 km^2 for Vancouver Island and Gulf Islands) (Figure 4). Approximately 15% of the global range is estimated to be in Canada.

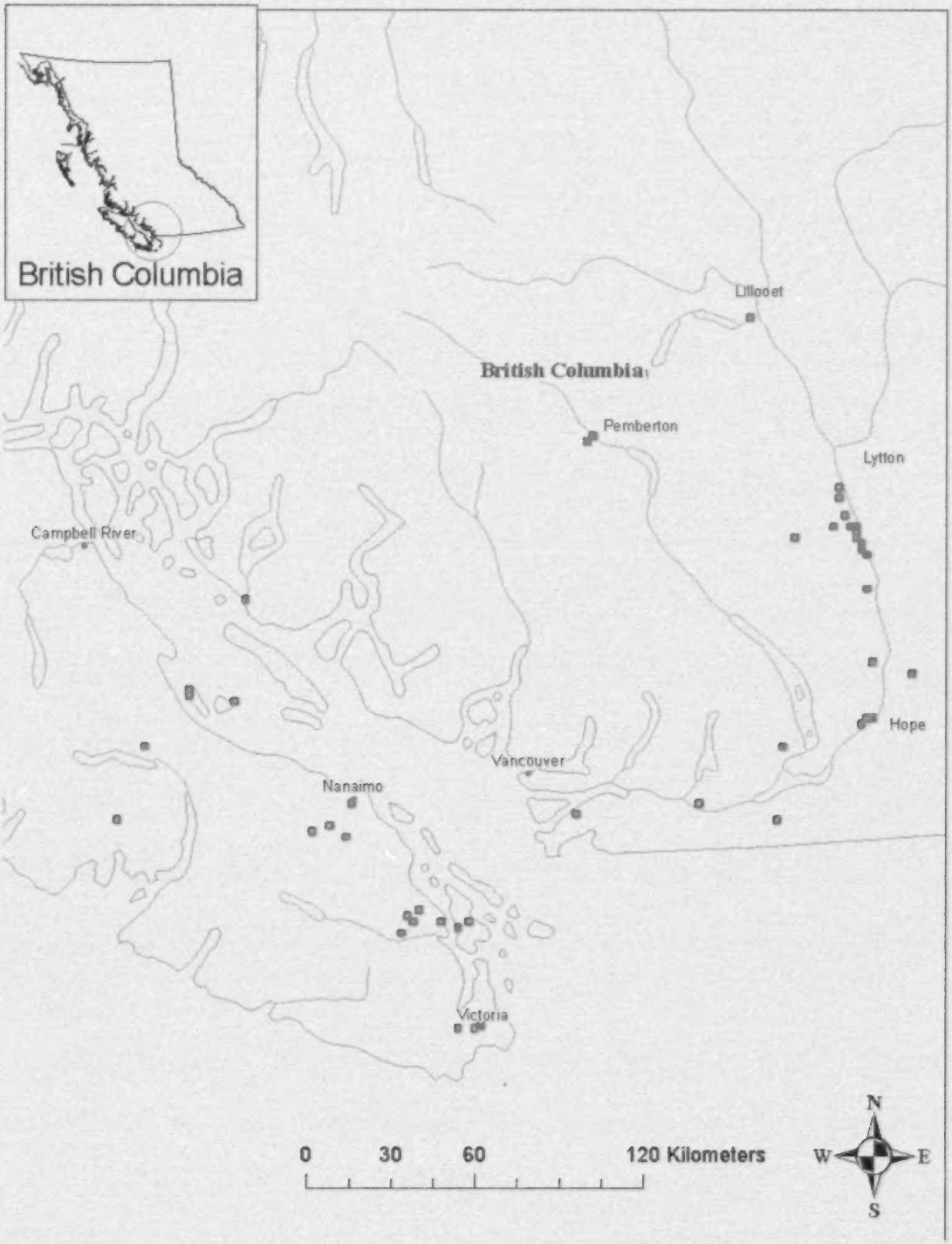

Figure 4. Canadian range of the Dun Skipper, as illustrated with point data. The map shows the general site for unknown data records at Powell River (one record) and Hope (one record). These sites are not included in the IAO calculations in Figure 5.

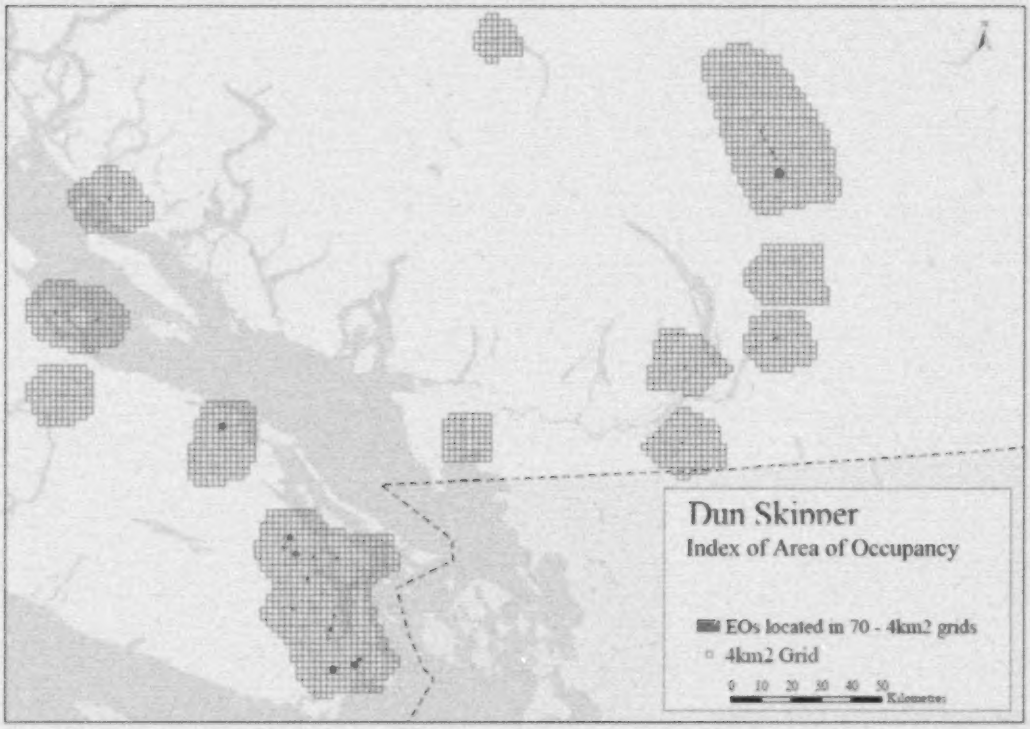

Figure 5. Dun Skipper distribution, overlain with 2x2 km grid, showing an index of area of occupancy of 280 km^2. IAO for extant sites (31 known sites) is 236 km^2. IAO is calculated from mapped polygons provided by the B.C. Conservation Data Centre (2010). The map excludes the sites for which extant status is unknown, but these sites are listed in Table 1 and included in the calculation.

Since the initial status report in 2000 (Shepard 2000b), the northeastern edges of the range have had significant search effort (Figure 6), and the range has been extended slightly, specifically within the Hope area and within a 25 km stretch of habitat through Boston Bar (see number 16, Figure 6) (Knopp *et al.* 2007, 2009, 2010). Yet search effort in 2010 provided substantial null data, suggesting the range limit may now be well known along the lower Fraser Valley (D. Knopp pers. comm. 2010; Knopp *et al.* 2010). The northern range limit along the Sunshine Coast may extend approximately 50 km north of Powell River to Lund (Figure 4) although north of Lund habitat is difficult to access (no roads) and the open wet disturbed and meadow habitats are less common. Search effort by Page *et al.* (2009, 2010) suggests there is less suitable habitat north of Comox toward Campbell River (Figure 6). The combined possible search area where the extent of occurrence may be extended on the Sunshine Coast and Vancouver Island is at the most approximately 2000 km^2, an increase in possible EO of about 6 per cent.

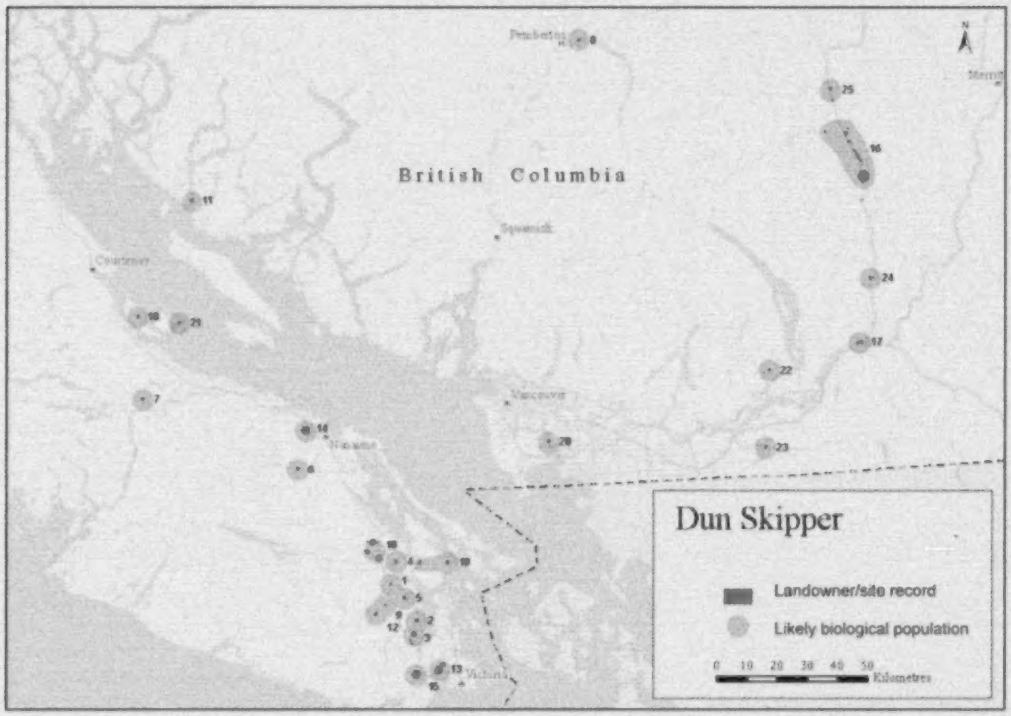

Figure 6. Dun Skipper site records nested within numbered biological populations (see Tables 1, 6).

Table 1. Detailed Dun Skipper collection records, sightings and site names (B.C. Conservation Data Centre 2012). The number in the first column refers to the biological population named in Table 6 and mapped in Figure 6.

Summary of Table 1

Total number of landowners: 51 (maximum, given the unknown land ownership and vague collection records) comprised of:

- 2 federal Indian Reserves
- 26 private landowners including
  - 1 private conservation land (Denman Conservancy Association);
  - 3 local government land parks: Thetis Lake Capital Regional District Park; Francis/King Capital Regional District Park; Burns Bog Metro Vancouver Ecological Conservancy Area
- 3 Provincial Parks – Helliwell Provincial Park; Somenos Ecological Reserve, Burgoyne Provincial Park
- 14 B.C. Crown land (forest land, excluding provincial parks), each parcel is considered separate; all sites are on the mainland.
- Number of sites with unknown landowner status and not possible to determine extirpated or extant): 5
  - 2 sites (3 collection records) unknown as to whether or not record was within Goldstream Provincial Park (2 collection years) and Spectacle Lake Provincial Park (1 collection year), or on private land adjacent to these parks, because the records are vague and historic.
  - 3 sites with vague historic collection data and where the current general area has extensive development.
- Number of extant sites (sites confirmed and skipper observed from 2001 – present): 25/51 (50%) sites belonging to 17 biological populations (Figure 6 numbers 3, 6, 7-10, 12, 16-25) and 28 different landowners.
- Number of sites with no observations since 2001 and/or likely extirpated: 11/50, belonging to 8 biological populations (1, 2, 4, 5, 11, 13, 14, 15)

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
1	Cowichan Station (Vancouver Island)	1996: One observation.	1996-07-15	Marven, D.	B.C. Conservation Data Centre 2012	Private	Extirpated likely (1996)	1
2	Old Quarry Road (Vancouver Island)	1996: One observation at edge of clear-cut.	1996-07-21	Marven, D.	B.C. Conservation Data Centre 2012	Private	Extirpated likely (1996)	1
3	Colpman Creek (Vancouver Island)	1994: Colpman Creek: 1 observation at edge of clear-cut; low bush and sparse grass.	1994-07-10	Ansell, S. and G. Ansell	B.C. Conservation Data Centre 2012	Private	Extirpated likely (1994)	1
3	Spectacle Lake (Vancouver Island)	1956: Spectacle Lake: 1 female collected; specimen located at RBCM.	1956-07-05	Hardy, G.A.	Shepard 2000b	Unknown (Private or Provincial Park)	Extirpated likely (1956)	1
3	Spectacle Lake (Vancouver Island	1963: Spectacle Lake: 1 male collected; specimen located at RBCM	1963-06-05	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1963)	N/A - counted above
3	Van Home Creek (Vancouver Island)	2003: Van Home Creek: 2 observations at intersection of Shawnigan Lake Road and E/N Railway	2003-07-22	Miskelly, J.	B.C. Conservation Data Centre 2012	Private	Extant (2003)	1
4	Mount Tzuhalem (Vancouver Island)	1994: One observation. In rough grass at edge of gravel road. Lots being developed along this road - this precise site may now be gone but likely habitat remaining.	2004 (unknown date)	N/A	B.C. Conservation Data Centre 2012	Private	Extirpated (2004)	1
5	Cobble Hill (Vancouver Island)	1995: One observation	1995-06-18	Ansell, S. and G. Ansell	B.C. Conservation Data Centre 2012	Private	Extirpated likely (1995)	1
6	Nanaimo Lakes Rd (Vancouver Island)	1988: One collected	1988	Guppy, C.	B.C. Conservation Data Centre 2012	Private Forestland	Extant (1988; 2010; 2011)	1
6	Nanaimo Lakes Rd (Vancouver Island)	2010: 7 observed during surveys	2010	Lilley, P.	Page, Lilley and Heron 2010	N/A - counted above	N/A - counted above (2010	N/A - counted above
6	Nanaimo Lakes Rd (Vancouver Island)	2011: 9 observed during surveys	2011	Parkinson. L. and J. Brooks	J. Heron pers. data 2011	N/A - counted above	N/A - counted above (2011)	N/A - counted above
7	Port Alberni, northeast of (Vancouver Island)	2003: 10-20 observed nectaring on Self-heal (*Prunella vulgaris*) over a 0.2 ha logged area. Cherry Creek Area	2003-07-31	Avis, R.	B.C. Conservation Data Centre 2012	Private	Extant (2003)	1
8	Mount Currie (Mainland)	2001: 3 observations on Self-heal	2001-07-03	Marven, D.	B.C. Conservation Data Centre 2012	Private	Extant (2001)	1
8	Mount Currie (Mainland)	2001: 11 observations on Self-heal	2001-07-05	Marven, D.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2001)	N/A - counted above
8	Mount Currie (Mainland)	2001: 3 observations on Self-heal	2001-07-04	Marven, D.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2001)	N/A - counted above

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
9	Shawnigan Lake, west of (Vancouver Island)	2003: 7 observations. Observed at south side of Kinsol Trestle.	2003-07-17	Miskelly, J.	B.C. Conservation Data Centre 2012	Private	Extant (2003)	1
9	Shawnigan Lake, west of (Vancouver Island)	2003: 2 observations. Observed at south side of Kinsol Trestle.	2003-07-22	Miskelly, J.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2003)	N/A - counted above
9	Shawnigan Lake, west of (Vancouver Island)	2003: 1 observations. Observed at south side of Kinsol Trestle.	2003-08-03	Miskelly, J.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2003)	N/A - counted above
10	Big Sicker Mountain, Mount Prevost Road (Vancouver Island)	2003: One observation at Big Sicker Mountain.	2003-07-18	Miskelly, J.	B.C. Conservation Data Centre 2012	Private	Extant (2003)	1
10	Little Sicker Mountain (Vancouver Island)	1963: 1 male collected; specimen at American Museum of Natural History.	1963-05-28	Guppy, R.	Shepard 2000b	Private	Unknown (1954)	1
10	Little Sicker Mountain (Vancouver Island)	1963: 1 male collected; specimen at American Museum of Natural History.	1963-06-22	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1963)	N/A - counted above
10	Little Sicker Mountain (Vancouver Island)	1976: 1 male collected (N. Kondla collection).	1976-07-23	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1963)	N/A - counted above
10	Little Sicker Mountain (Vancouver Island)	1954: 1 female collected; specimen at American Museum of Natural History.	1954-06-24	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1976)	N/A - counted above
10	Mount Prevost (Vancouver Island)	1956: 2 males collected; specimens are at Royal BC Museum.	1956-07-14	Hardy, G.A.	Shepard 2000b	Private	Unknown (1956)	1
10	Mount Prevost (Vancouver Island)	1956: 2 males collected; specimens are at Royal BC Museum.	1956-07-07	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1956)	N/A - counted above
10	Somenos Garry Oak Protected Area (Vancouver Island)	1976: 1 male collected; (N. Kondla collection).	1976-07-30	Guppy, R.	Shepard 2000b	B.C. Crown (Provincial Park)	Extirpated likely (1976)	1
10	Somenos Garry Oak Protected Area (Vancouver Island)	1977: 1 male collected; (N. Kondla collection).	1977-07-13	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1977)	N/A - counted above
10	Somenos Garry Oak Protected Area (Vancouver Island)	1978: 1 male collected; (N. Kondla collection).	1978-07-14	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1978)	N/A - counted above
11	Powell River (Mainland)	No date or observation information	No date	N/A	Shepard 2000b	Unknown	Unknown (date unknown)	1
12	Koksilah River (Vancouver Island)	2003: 1 seen in a clear-cut next to Koksilah Provincial Park.	2003-07-30	Miskelly, J.	B.C. Conservation Data Centre 2012	Private	Extant (2003)	1

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
13	Francis King Park (Vancouver Island)	1962: Francis/King Park: 2 males collected (RBCM Specimens).	1962-07-02	Hardy, G.A.	Shepard 2000b	B.C. Crown (Provincial Park)	Extirpated likely (1962)	1
13	Francis King Park (Vancouver Island)	1962: Francis/King Park: 1 male collected (RBCM specimen).	1962-07-16	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1962)	N/A - counted above
13	Francis King Park (Vancouver Island)	1962: Francis/King Park: 1 male collected (RBCM specimen).	1962-07-22	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1962)	N/A - counted above
13	Francis King Park (Vancouver Island)	1962: Francis/King Park: 1 male collected (RBCM specimen).	1962-07-27	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1962)	N/A - counted above
13	Francis King Park (Vancouver Island)	1962: Francis/King Park: 1 male collected (RBCM specimens).	1962-07-09	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1962)	N/A - counted above
13	Thetis Lake Park (Vancouver Island)	1962: Thetis Lake Park: 2 males collected (RBCM specimen).	1962-07-21	Hardy, G.A.	Shepard 2000b	Local government (Capital Regional District)	Extirpated likely (1962)	1
13	Thetis Lake Park (Vancouver Island)	1963: Thetis Lake Park: 1 female collected (RBCM specimen).	1963-07-16	Hardy, G.A.	Shepard 2000b	N/A - counted above	N/A - counted above (1963)	N/A - counted above
14	Wellington (Vancouver Island)	1951: 2 males collected; specimens (California Academy of Sciences)	1951-06-26	Guppy, R.	Shepard 2000b	Private	Extirpated likely (1951)	4
14	Wellington (Vancouver Island)	1960: 2 females collected specimens (California Academy of Sciences.)	1960-08-05	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1960)	N/A - counted above
14	Wellington (Vancouver Island)	1963: 1 male collected; specimens held at American Museum of Natural History.	1963-07-26	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1963)	N/A - counted above
14	Wellington (Vancouver Island)	1979: 1 male collected; N. Kondla collection.	1979-06-24	Guppy, R.	Shepard 2000b	N/A - counted above	N/A - counted above (1979)	N/A - counted above
15	Goldstream (Vancouver Island)	1902: 1 male collected; specimen located at University of British Columbia.	1902-07-02	Blackmore, E.H.	Shepard 2000b	Unknown (Private or Provincial Park)	Extirpated likely (1902)	2 (accounts for possibility there are two landowners – private or provincial park)
15	Goldstream (Vancouver Island)	1902: 1 female collected; specimen located at University of British Columbia.	1902-07-03	Blackmore, E.H.	Shepard 2000b	N/A - counted above	N/A - counted above (1902)	N/A - counted above
15	Goldstream (Vancouver Island)	1902: 1 female collected; specimen located at University of British Columbia.	1902-07-27	Blackmore, E.H.	Shepard 2000b	N/A - counted above	N/A - counted above (1902)	N/A - counted above
15	Goldstream (Vancouver Island)	1902: 1 male collected; specimen located at University of British Columbia.	1902-07-20	Blackmore, E.H.	Shepard 2000b	N/A - counted above	N/A - counted above (1902)	N/A - counted above

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
15	Goldstream (Vancouver Island)	1904: 1 male collected; specimen located at Royal British Columbia Museum.	1904-07-01	Unknown	Shepard 2000b	N/A - counted above	N/A - counted above (1904)	N/A - counted above
15	Goldstream (Vancouver Island)	1904: 1 male collected; specimen located at Royal British Columbia Museum.	1904-07-19	Unknown	Shepard 2000b	N/A - counted above	N/A - counted above (1904)	N/A - counted above
15	Goldstream (Vancouver Island)	1923: 1 female collected; specimen located at University of British Columbia.	1923-06-24	Auden, K.F.	Shepard 2000b	N/A - counted above	N/A - counted above (1923)	N/A - counted above
15	Goldstream (Vancouver Island)	1923: 1 male collected; specimen located at University of British Columbia.	1923-06-17	Auden, K.F.	Shepard 2000b	N/A - counted above	N/A - counted above (1923)	N/A - counted above
15	Goldstream (Vancouver Island)	1923: 1 male collected; specimen located at Washington State University.	1923-07-11	Clarke, J.F.G.	Shepard 2000b	N/A - counted above	N/A - counted above (1923)	N/A - counted above
16	Boston Bar (Mainland)	1949: 1 male collected; specimen held at Royal BC Museum. The sites range along about 25 km of the highway.	1949-06-05	Cooper, J.K.	Shepard 2000b	Unknown (private or B.C. Crown)	Unknown (1949)	1
16	Boston Bar (Mainland)	1949: 2 males collected; specimens held at Royal BC Museum. The sites range along about 25 km of the highway.	1949-06-06	Cooper, J.K.	Shepard 2000b	N/A - counted above	N/A - counted above (1949)	N/A - counted above
16	Boston Bar; Ainslie Creek (Mainland)	2002: 1 adult of undetermined sex observed. The sites range along about 25 km of the highway.	2002-06-25	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1
16	Boston Bar; Green Canyon (Mainland)	2002: 1 adult of undetermined sex observed. The sites range along about 25 km of the highway.	2002-06-21	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1
16	Boston Bar; Green Canyon (Mainland)	2002: 12 adults observed of unknown sex; 2 more observed 'at logging road'. The sites range along about 25 km of the highway.	2002-06-22	Knopp, D. and C. Guppy	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2002)	N/A - counted above
16	Boston Bar; Green Canyon (Mainland)	2002: 6 adults of undetermined sex observed. The sites range along about 25 km of the highway.	2002-07-03	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2002)	N/A - counted above
16	Boston Bar; Green Canyon (Mainland)	2003: 2 adults of undetermined sex observed. The sites range along about 25 km of the highway.	2003-06-24	Knopp, D. and D. Threatful	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2003)	N/A - counted above

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
16	Boston Bar; Green Canyon (Mainland)	2007: 1 adult female with worn and tattered wings was observed nectaring on dogbane growing within close proximity to a dry vernal pool that had formed in a depression and was surrounded by sedges. The sites range along about 25 km of the highway.	2007-08-02	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2007)	N/A - counted above
16	Boston Bar; Inkahtsaph Creek (Mainland)	2002: 1 male and 1 female collected from the highway. The sites range along about 25 km of the highway.	2002-06-23	Guppy, C.	B.C. Conservation Data Centre 2012	Private	Extant (2002)	1
16	Boston Bar; Logging Road (Mainland)	2002: 1 adult of undetermined sex observed along logging road. The sites range along about 25 km of the highway.	2002-06-22	Knopp, D. and C. Guppy	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1
16	Boston Bar; Logging Road (Mainland)	2002: 8 males and 1 female collected at a logging road. The sites range along about 25 km of the highway.	2002-06-23	Guppy, C.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2002)	N/A - counted above
16	Boston Bar; N of Jamieson Creek (Mainland)	2002: Two males and one female collected from a ditch on the side of the highway. The sites range along about 25 km of the highway.	2002-06-23	Guppy, C.	B.C. Conservation Data Centre 2012	Private	Extant (2002)	1
16	Boston Bar; S of Fishblue Lake Turnoff (Mainland)	2002: 1 adult of undetermined sex; nectars on white-rein orchid. The sites range along about 25 km of the highway.	2002-06-25	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1
16	Boston Bar; Sho-ook Indian Reserve (Mainland)	2002: 7 adults of undetermined sex observed performing a mating display. The sites range along about 25 km of the highway.	2002-06-25	Knopp, D.	Knopp *et al.* 2008	Federal Indian Reserve	Extant (2002)	1
16	Ceanothus Hills (Mainland)	2002: 1 adult of undetermined sex observed on high peak on Boothroyd IR 6A. The sites range along about 25 km of the highway.	2002-02-26	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1
16	Ceanothus Hills (Mainland)	2002: 2 adults of unknown sex observed on eastern hilltop. The sites range along about 25 km of the highway.	2002-07-05	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2002)	N/A - counted above
16	Hell's Gate, South of	2002: 3 adults of undetermined sex observed. The sites range along about 25 km of the highway.	2002-06-25	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
16	Nahatlatch Forest Service Road (Mainland)	2007: One male observation was near the muddy edge of a creek adjacent to a large and flat artificial clearing on the west side of the forest service road. The sites range along about 25 km of the highway.	2007-07-13	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2007)	1
17	"Hope" (Mainland)	1918: 1 male specimen collected from Hope (Shepard 2000). The only information for this record is the date and "Hope", therefore habitat or detailed site unknown.	1918		Shepard 2000b	Unknown	Extant (2007)	1
17	Gas Pipeline Crossing Hwy 7 (Mainland)	2002: 2 individuals observed in this site (Knopp *et al.* 2008).	2002-07-03	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	N/A - counted above (2007)	1
17	Gas Pipeline Crossing Hwy 7 (Mainland)	2007: 13 adults observed at 3 sites (2 male, 1 female, 10 unknown). South-facing cliff on Hwy#7 with hydro right-of-way at base.	2007-07-05	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2007)	N/A - counted above
17	Gas Pipeline Crossing Hwy 7 (Mainland)	2007: 6 adults observed, spread out throughout area: 1 female, 5 unknown.	2007-07-09	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2007)	N/A - counted above
18	Denman Island	2007: Two individuals observed in regenerating clearcut.	2007	Guppy, C.	Guppy *et al.* 2007	Private (Conservation Land)	Extant (2007)	1
19	Andrew Place (Salt Spring Island, Gulf Islands)	2003 : observation on either side of the road, basking in the long grass and nectaring on blue sage	2003-08-12	van Patten, N.	B.C. Conservation Data Centre 2012	Private	Extant (2008)	1
19	Andrew Place (Salt Spring Island, Gulf Islands)	2004: observation on either side of the road, basking in the long grass and nectaring on blue sage	2004-06-22	van Patten, N.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2009)	N/A - counted above
19	Andrew Place (Salt Spring Island, Gulf Islands)	2007: 1 male observed within 500m of previous sightings. 1 male observed basking and flying within 500m of previous observations. Potential breeding habitat is approximately 200 square metres.	2007-07-16	Miskelly, J. and R. Annschild	B.C. Conservation Data Centre 2012	N/A - counted above	Extant (2003)	N/A - counted above
19	Burgoyne Bay Provincial Park	2008: 1 observation	2008	Retzer Miller, C.	C. Retzer Miller pers. comm. 2010	B.C. Crown (Provincial Park)	N/A - counted above (2004)	1
19	Burgoyne Bay Provincial Park (Salt Spring Island)	2009: 1 observation	2009	Retzer Miller, C.	C. Retzer Miller pers. comm. 2011	N/A - counted above	N/A - counted above (2007)	N/A - counted above

Biological population number (Figure 6)	Site name or collection name*	Observation information	Observation date	Observer/ collector (as stated at BC CDC)	Reference for observation	Land tenure	Considered extant (record > 2001) or extirpated (record < 2001)	Number of landowners
20	Burns Bog 72nd Ave & Hwy (Mainland)	2004: 5 Dun Skippers observed.	2004-06-25	Heron, J.	B.C. Conservation Data Centre 2012	Private	Extant (2004)	4
21	Helliwell Provincial Park (Hornby Island, Gulf Islands)	2004: 1 Dun Skipper observed adjacent to Garry oak and pine woodland area, about 15 metres off the trail along the forest edge, within grasses.	2004-SU	Heron, J.	B.C. Conservation Data Centre 2012	B.C. Crown (Provincial Park)	Extant (2004)	1
21	Helliwell Provincial Park (Hornby Island, Gulf Islands)	2004: 1 Dun Skipper observed.	2004-06	Miskelly, J.	B.C. Conservation Data Centre 2012	N/A - counted above	N/A - counted above (2004)	N/A - counted above
22	Morris Valley Hemlock Valley Ski Hill Road (Mainland)	2007: 1 male observed in weedy area at the junction of logging road and Hemlock Ski Hill Road.	2007-07-04	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2007)	1
23	Soowahlie Indian Reserve 14 (Mainland)	2004: One individual observed near old gravel pit. 1 adult of unknown sex	2004-06-27	Knopp, D.	Knopp *et al.* 2008	Federal Indian Reserve	Extant (2004)	1
24	Yale	2001: 4 individuals observed just north of the Community of Yale taking nectar on heal-all.	2001-07-05	Knopp, D.	B.C. Conservation Data Centre 2012	Private	Extant (2001)	1
25	Conrad; Highway pull-off (Mainland)	2007: Five individuals at a highway pull off. Three male and two females.	2007-07-14	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2007)	1
25	Conrad; Highway pull-off (Mainland)	2007: One observation nectaring on alfalfa adjacent to culvert.	2007-07-28	Knopp, D.	Knopp *et al.* 2008	N/A - counted above	N/A - counted above (2007)	N/A - counted above
25	Highway 1 Seep (Mainland)	2002: one individual at a roadside seep.	2002-06-26	Knopp, D.	Knopp *et al.* 2008	B.C. Crown	Extant (2002)	1

Table 2. Recent surveys that included Dun Skipper habitat.

General survey sites and date	Person hours searched during Dun Skipper flight season	Distance searched	Dun Skipper found during survey	Historic sites included in this survey	Report citation
2001, Southern Vancouver Island and Gulf Islands	N/A	N/A	None	Unknown	Guppy and Fisher 2001
2003, Hornby Island Butterfly Inventory	106	N/A	None	N/A	Miskelly 2003
2004, Metro Vancouver Parks	41 hours	13 parks	None	None	Grant 2004
2007, Denman and Hornby islands April 28 – June 13 (private and public land)	168.4 hours	288.1 km	None	Helliwell Provincial Park; remainder of habitat searched was for new records.	Page *et al.* 2007
2007, Denman Island Settlement Lands	N/A	N/A	2	N/A	Guppy *et al.* 2007
2007, Gulf Islands National Park Reserve (May through August)	90.7 hours	18 sites (total area 1589 ha); 4 visits to each site	None	None	Fenneman 2008

General survey sites and date	Person hours searched during Dun Skipper flight season	Distance searched	Dun Skipper found during survey	Historic sites included in this survey	Report citation
2007, Lower Fraser Valley	7.7 hours (at confirmed localities only)	4.3 km at confirmed localities; 500 km roads searching for suitable habitat	22 observations; 5 sites	None	Knopp *et al.*2007
2008, Burgoyne Bay Provincial Park, Salt Spring Island	N/A	N/A	1 observation; one site	None	Miskelly 2009
2008, Courtenay, Comox, Denman island and Hornby island, May 15 – June 14 (private and public land)	64.3 hours	72.5 km (58.6 km by foot; 13.9 km by car)	None	Helliwell Provincial Park; remainder of habitat searched was for new records.	Page *et al.*2008a
2008, Gulf Islands National Park Reserve (federal) May through August	N/A	18 sites (total area 1589 ha); 4 visits to each site	None	no historic records known from these survey sites	Guppy 2009
2008, Southern Vancouver Island May 4 – May 17, 2008 (private land)	59.3 hours	95.6 km	None	None	Page *et al.* 2008b
2009, Burgoyne Bay Provincial Park, Salt Spring Island	N/A	N/A	1 observation; 1 site	None	Miskelly 2008
2009, Courtenay, Comox and other areas on southern Vancouver Island 2009 (private land) May 21 – August 26, 2009	104.2 hours	380.7 km	None	Courtenay and Comox areas (although specific site of historic record is unknown)	Page, Lilley and Heron 2009
2009, Denman Island 2009 (private land)	17 days, 2 – 3 surveyors per day	NA ~ 809 ha area	None	N/A	J. Heron, pers. data 2010
2009, Harrison Lake Area, lower Fraser Valley	91.7 hours	217.8 km	None	None	Parkinson *et al.* 2009
2009, Lepidoptera surveys in Victoria Parks May 30 – 31, 2009	6.2 hours	20.8 km through 8 parks in the City of Victoria	None	N/A	Page and Lilley 2009
2009, Lower Fraser Valley	107 hours (foot); 2,555 km vehicle (scanning appropriate sites); 233 km boat (shoreline habitat)	17 km (foot)	2 confirmed; 3 unconfirmed	None	Knopp *et al.* 2009
2010 Lower Fraser Valley	59 hours (foot)	48 km (foot); 4334 km (vehicle); 62 km (boat)	9 confirmed	2 previously known sites	Knopp *et al.*2010
2010, Butterfly Surveys in southeastern Vancouver Island	106.2 hours	332.2 km	18 observations; 3 sites	7 previously known sites	Page *et al.* 2010
2011, Butterfly Surveys in southeastern Vancouver Island	117.5 hours	203.7 km	9 (2 confirmed; 7 (unconfirmed)	Previously known site	Heron pers. data 2011
Total	1129.2 hours minimum by walking	1660.7 walking; 4847 driving (assessing habitat by slowly travelling logging roads)	67 Dun Skippers		

Table 3. Academic butterfly research studies within the range and potential habitat of the Dun Skipper. Some of these studies were not specifically targeting Dun Skippers, and were only for a portion of the species flight period. However, if the species was present the researcher would have noted the occurrence.

General survey area	Component of research applicable to Dun Skipper search effort	Dates	Researcher or citation
Southern Vancouver Island	Butterfly research in Garry Oak ecosystems at a minimum of nine sites	2004 – 2009	J. Hellmann pers. comm. 2009
Salt Spring Island	Butterfly research in Garry Oak ecosystems	2004 – 2009	D. Clements, pers. comm. 2008
Southern Vancouver Island	Pollinator research in Garry Oak ecosystems	2004 – 2009	E. Elle pers. comm. 2009
Southern Vancouver Island	Butterfly research in Garry Oak ecosystems	2003 – 2005	W. Hallstrom pers. comm. 2009
Lower Fraser Valley	Pollinator and butterfly surveys on farms, gardens, parks and agricultural lands in the lower Fraser Valley	2010	Parkinson and Heron 2010

Table 4. Yearly life cycle of the Dun Skipper in B.C. (B.C. Conservation Data Centre, 2011).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Eggs					—	—	—					
Larvae				·····	·····	·····	·····	·····				
Dormant Larvae	—	—	—				—	—	—	—	—	
Pupae (brief)			—	—								
Adults				—	—	—	—					

Table 5. IUCN Threats calculator results for Dun Skipper (*Euphyes vestris*) in Canada.

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by COSEWIC, B.C. Conservation Data Centre and B.C. Conservation Framework (B.C. Ministry of Environment 2011a). For a detailed description of the threat classification system, see the Conservation Measures Partnership web site (CMP 2010). For information on how the values are assigned, see Master *et al.* (2009) and table footnotes for details. Threats for Dun Skipper were assessed across the species geographic range in Canada (Table 1).

Dun Skipper (*Euphyes vestris*)			
Date of Assessment: 2013-01-28			
Assessors: Jennifer Heron, Dave Fraser, Lea Gelling, Leah Ramsay			
		Level 1 Threat Impact Counts	
Threat Impact		**high range**	**low range**
A	**Very High**	0	0
B	High	0	0
C	Medium	1	1
D	Low	3	3
	Calculated Overall Threat Impact:	High	High

Threat		**Impact (calculated)**	**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**
1	Residential & commercial development	Medium	Restricted (11-30%)	Serious (31-70%)	High - Moderate
1.1	Housing & urban areas	Medium	Restricted (11-30%)	Serious (31-70%)	High (Continuing)
1.2	Commercial & industrial areas	Low	Small (1-10%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
1.3	Tourism & recreation areas	Low	Small (1-10%)	Serious (31-70%)	Moderate (Possibly in the short term, < 10 yrs)
2	Agriculture & aquaculture				
2.1	Annual & perennial non-timber crops	Low	Small (1-10%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
3	Energy production & mining				
3.2	Mining & quarrying	Low	Small (1-10%)	Moderate (11-30%)	Unknown
4	Transportation & service corridors	Low	Large (31-70%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
4.1	Roads & railroads	Low	Large (31-70%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
4.2	Utility & service lines	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
5	Biological resource use	Negligible	Negligible (<1%)	Slight (1-10%)	Insignificant/Negligible (Past or no direct effect)
5.3	Logging & wood harvesting	Negligible	Negligible (<1%)	Slight (1-10%)	Insignificant/Negligible (Past or no direct effect)
6	Human intrusions & disturbance	Negligible	Negligible (<1%)	Negligible (<1%)	Insignificant/Negligible (Past or no direct effect)
6.1	Recreational activities	Negligible	Negligible (<1%)	Negligible (<1%)	Insignificant/Negligible (Past or no direct effect)
7	Natural system modifications	Not a Threat (in the assessed timeframe)	Pervasive (71-100%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
7.1	Fire & fire suppression	Not a Threat (in the assessed timeframe)	Pervasive (71-100%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
8	Invasive & other problematic species & genes	Low	Restricted (11-30%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
8.1	Invasive non-native/alien species	Low	Restricted (11-30%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
8.2	Problematic native species	Low	Restricted (11-30%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
9	Pollution	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)
9.3	Agricultural & forestry effluents	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)
9.4	Garbage & solid waste	Not a Threat (in the assessed timeframe)	Small (1-10%)	Unknown	Insignificant/Negligible (Past or no direct effect)
10	Geological events	Not a Threat (in the assessed timeframe)	Small (1-10%)	Unknown	Moderate (Possibly in the short term, < 10 yrs)

Threat		Impact (calculated)	Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing
10.2	Earthquakes/tsunamis	Not a Threat (in the assessed timeframe)	Small (1-10%)	Unknown	Moderate (Possibly in the short term, < 10 yrs)
11	Climate change & severe weather	Not a Threat (in the assessed timeframe)	Small (1-10%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
11.2	Droughts	Not a Threat (in the assessed timeframe)	Unknown	Unknown	Low (Possibly in the long term, >10 yrs)
11.4	Storms & flooding	Not a Threat (in the assessed timeframe)	Small (1-10%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each stress is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: very high (75% declines), high (40%), medium (15%), and low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity is unknown).

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%)

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

[e] **Locations** – See Table 1 for site names.

Table 6. IUCN threats applicable to each biological population of Dun Skipper. Threats were assigned to all biological populations, whether extant (records from 2001 or more recent) or extirpated (records from 2000 or earlier); thus taking into account the remote possibility the skipper may have been missed during recent surveys and the remote possibility the skipper could remain within small areas of unchecked habitats at these biological populations.

Biological population	Biological population name (B.C. CDC)	Notes on threats	1.1	1.2	1.3	2.1	2.2	2.3	3.2	4.1	4.2	5.3	6.1	7.1	8.1	8.2	9.1	9.3	10.2	11.2	11.4
Threats applicable		Notes on threats other than 7.1, 8.1 8.2, 9.3, 11.2 which apply to all biological populations.	4	1	1	1	Likely neutral	Likely neutral	1	8	4	0	0	25	25	25	1	25	1	25	1
1	Cowichan Station (Vancouver Island)	Natural forest succession, ongoing logging within the area may open new habitat, clear other habitat and logging roads/ditching may impact some sites. Overall threat may balance out.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
2	Mill Bay, Malahat Ridge (Vancouver Island)	Natural forest succession within the clear-cut where the species was observed. Logging activities or the use of open seasonally wet areas as landings, gravel pits, or forestry works. Potential recreational use (although minor).	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
3	Malahat, Colpman and van Home Creeks; Spectacle Lake (Vancouver Island)	Potential highways maintenance activities; natural forest/vegetative succession.	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0
4	Mount Tzuhalem; Maple Bay (Vancouver Island)	Potential for low density housing development; agricultural land clearing and ongoing livestock grazing is considered negligible. Primarily cumulative impacts from numerous threats but overall likely to create habitat too.	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0

Biological population	Biological population name (B.C. CDC)	Notes on threats	1.1	1.2	1.3	2.1	2.2	2.3	3.2	4.1	4.2	5.3	6.1	7.1	8.1	8.2	9.1	9.3	10.2	11.2	11.4
5	Cobble Hill (Vancouver Island)	The Cobble Hill area is rural with some small scale urban/housing development. Most of area is agricultural: land clearing (for agriculture), some livestock grazing and cumulative impacts from other listed threats. All these were considered low threats	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
6	Nanaimo River (Vancouver Island)	Sites are along a logging road and utility right-of-way. Threats include natural forest succession, ongoing maintenance of roadsides (e.g., clearing and road maintenance), utility corridor maintenance and upkeep.	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	1	0
7	Port Alberni, northeast of (Vancouver Island)	Natural forest succession, ongoing logging within the area may open new habitat, clear other habitat and logging roads/ditching may impact some sites.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
8	Mount Currie (Mainland)	Rural area: livestock grazing, agricultural land practices (clearing), natural forest succession. All these threats are considered, some low.	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
9	Shawnigan lake, west of (Vancouver Island)	Some urban housing development, recreational property development and recreation during summer months. Most of the area is rural/agricultural with hobby farms.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
10	Big Sicker Mountain; Little Sicker Mountain; Mount Prevost; Somenos (Vancouver Island)	Unsurveyed habitats in these areas (lower elevation areas) are threatened by some land conversion (not Threat 1, other forms).	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
11	Powell River (Sunshine Coast, mainland)	There is no date with this record, difficult to assign threats. Threats are likely natural forest succession, ongoing logging within the area may open new habitat, clear other habitat and logging roads/ditching may impact some sites.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
12	Koksilah River (Vancouver Island)	Natural forest succession within the clear-cut where the species was observed. Logging activities or the use of open seasonally wet areas as landings, gravel pits, or forestry works. Potential recreational use (although minor).	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
13	Colquitz; Francis King Park and Thetis Lake Park (Vancouver Island)	Natural forest succession has likely been the main threat leading to the decline of butterflies within this area; growing naturally into the wetland and open areas. There is no logging in these areas.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
14	Wellington (Vancouver Island)	Natural forest succession, and cumulative impacts from agricultural/land clearing, etc. may create new habitats too.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0

Biological population	Biological population name (B.C. CDC)	Notes on threats	1.1	1.2	1.3	2.1	2.2	2.3	3.2	4.1	4.2	5.3	6.1	7.1	8.1	8.2	9.1	9.3	10.2	11.2	11.4
15	Goldstream (Vancouver Island)	This is a historic site, and the original habitat is unknown. Threats to this site are speculative based on the current knowledge of the area.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
16	Boston Bar (Lower Fraser Valley)	The area does not have high threats, and is on the periphery of Gypsy Moth spray zone. Potential threats include agricultural land conversion, livestock grazing and cumulative impacts of small-scale utility, service lines, roads, gravel quarrying, etc. Portions of the Lillooet River could flood (minor threat).	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	1	0
17	Dog Mountain (Lower Fraser Valley)	Maintenance of roadsides, clearing of areas for logging work, natural vegetative/forest succession.	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0
18	Denman Island (Northern Gulf Islands)	Large central marsh wetland complex, linked by many hectares of open clear-cuts. Dun Skipper has been recorded within clear-cuts, and likely occurs throughout this wetland and clear-cut complex. As natural forest succession occurs, the habitat will decline. The land is a mixture of private and public ownership, and private ownership is subject to agricultural land use (clearing), livestock grazing and small footprint housing/building development. A new provincial park has a carbon covenant which stipulates forest must grow, thus leading to decline of skipper habitat in the park areas.	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
19	Salt Spring Island; south east (Southern Gulf Islands)	Natural vegetative/forest succession; may also be habitats created too.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
20	Burns Bog (Lower Mainland)	Portions of Burns Bog are owned by local government (Metro Vancouver, City of Vancouver and Municipality of Delta and City of Vancouver [dump site]). Habitat is consistent throughout although the skipper has been recorded in one site. There is a municipal dump on a small portion of the bog; the South Perimeter Road runs through one side of the bog (habitat loss occurred from the road construction); the area is in the flood zone and tsunami zone; there is a portion in private ownership, with future plans to develop the area into an industrial park and potential urban housing area (plans are not defined yet).	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1
21	Hornby Island (Northern Gulf Islands)	Helliwell Provincial Park	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
22	Morris Lake, west of (Lower Fraser Valley)	Large scale ski hill development proposed at this site, increasing the footprint of the development. Dun Skipper site would be impacted because habitat would be cleared, areas would be ditched/piped to allow for housing and recreational development.	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	1	0	1	0

Biological population	Biological population name (B.C. CDC)	Notes on threats	1.1	1.2	1.3	2.1	2.2	2.3	3.2	4.1	4.2	5.3	6.1	7.1	8.1	8.2	9.1	9.3	10.2	11.2	11.4
23	Soowahlie Indian Reserve 14 (Lower Fraser Valley)	Natural forest succession, ongoing logging within the area may open new habitat, clear other habitat and logging roads/ditching may impact some sites; use of gravel pit.	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	1	0	1	0
24	Yale (Lower Fraser Valley)	Natural forest succession, ongoing logging within the area may open new habitat, clear other habitat and logging roads/ditching may impact some sites, and cumulative impacts from agricultural/land clearing, etc.	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0
25	Lytton, south of (Lower Fraser Valley)	Threats include potential highways maintenance activities; natural forest/vegetative succession.	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	1	0

The Dun Skipper has been recorded from 44 sites (Table 1). The index of area of occupancy (IAO) is estimated at 280 km^2 (based upon the minimum number of 2 km X 2 km squares that cover the habitat polygons where historic and extant sites occur in Figure 5). Eleven of these sites are considered extirpated/historic (records > 15 years old), reducing the extant index of area of occupancy to a minimum of 236 km^2. The status of five sites (e.g., extant or extirpated) is unknown but is still accounted for in the extant index of area of occupancy (Table 1). The actual IAO could be greater with the addition of new, undiscovered sites, but is not expected to exceed 500 km^2 (C. Guppy pers. comm. 2013; D. Knopp pers. comm. 2013).

Number of Locations Based on Threats

Dun Skipper habitat patches are considered highly fragmented and most are small, isolated, and not within protected areas. Based on the threat of habitat fragmentation and private land development (based on land ownership), there are approximately 51 separate known sites and thus 51 locations for the Dun Skipper (extant and extirpated). When only extant sites are considered (records since 2001) the number is reduced to 28 locations. Of these, at least three locations are subject to immediate land development (within the next three years) and at least 14 locations are within artificially created habitats (e.g., roadside pull-outs, pipeline crossing, recent clear-cut or regenerating clear-cut) that are rapidly changing from natural or invasive vegetative succession. The most intact population appears to be a thin, 25 km-long strip of habitat within the Boston Bar area (see number 16, Figure 6).

When the 51 extant and historic Dun Skipper locations are grouped into biological populations (i.e., a contiguous habitat patch that is likely not within the dispersal distance of any other biological population) (Figure 4; Table 5), there are 25 biological populations. If we assume that Dun Skippers occur within unsurveyed habitats adjacent to these 25 populations, and assess the threats to each of these biological populations (see Table 1 and 6), 11 biological populations (representing 14 locations) have inferred habitat reduction, based on the threat of vegetative succession. This corresponds to a predicted reduction of 56 km^2 (14 locations X 4 km^2) in the index of area of occupancy in the next ten years.

Other threats, such as the spraying of the insecticide Btk to control European Gypsy Moth (*Lymantria dispar* L.) (see Threats), would also impact the species throughout more than half of its range (see Figure 5). However, Btk is less likely than habitat loss or fragmentation to cause extirpation of local populations. See Threats section for further discussion.

Search Effort

Dun Skipper records in B.C. date from 1902 to 2011 (Table 1), with 209 records (observations or museum specimens) of the species. The first Canadian record is from Goldstream (1902) and the most recent are from the Fraser Canyon near Boston Bar (2010) (Knopp *et al.* 2010) and the Nanaimo River area (2011) (J. Heron pers. data 2011) (see Table 1). In the past ten years (2001 to 2011) there have only been 67 observations.

From 2001 to 2011 there has been substantial search effort for the Dun Skipper within the species' range in B.C. (Table 2; Figure 7). Along the coast, search effort has focused on southeastern Vancouver Island, Salt Spring Island, Galiano Island, Mayne Island and Gulf Islands National Park Reserve. On the southwestern mainland of B.C., search effort has specifically focused on the edges of the species' known range (e.g. Pemberton, Lillooet and Boston Bar) with the intent to confirm the edges of the species' range on the mainland. These areas also have active conservancies and a community of naturalists that are acutely aware of the species and its threatened status, and actively look for species at risk.

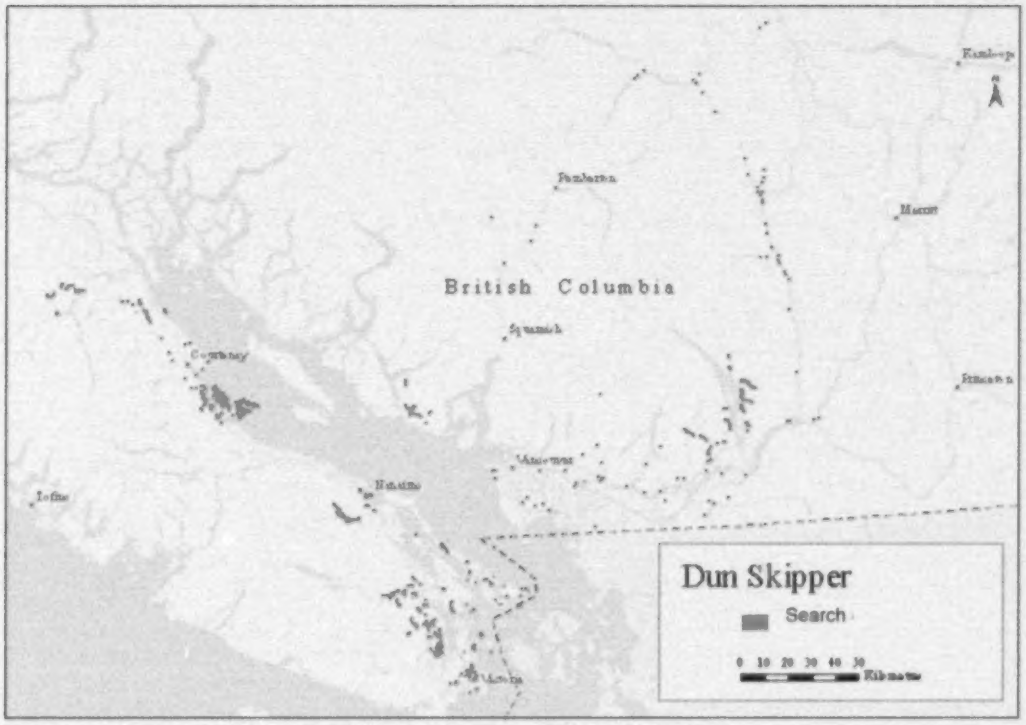

Figure 7. Search effort for the Dun Skipper, 2002-2012.

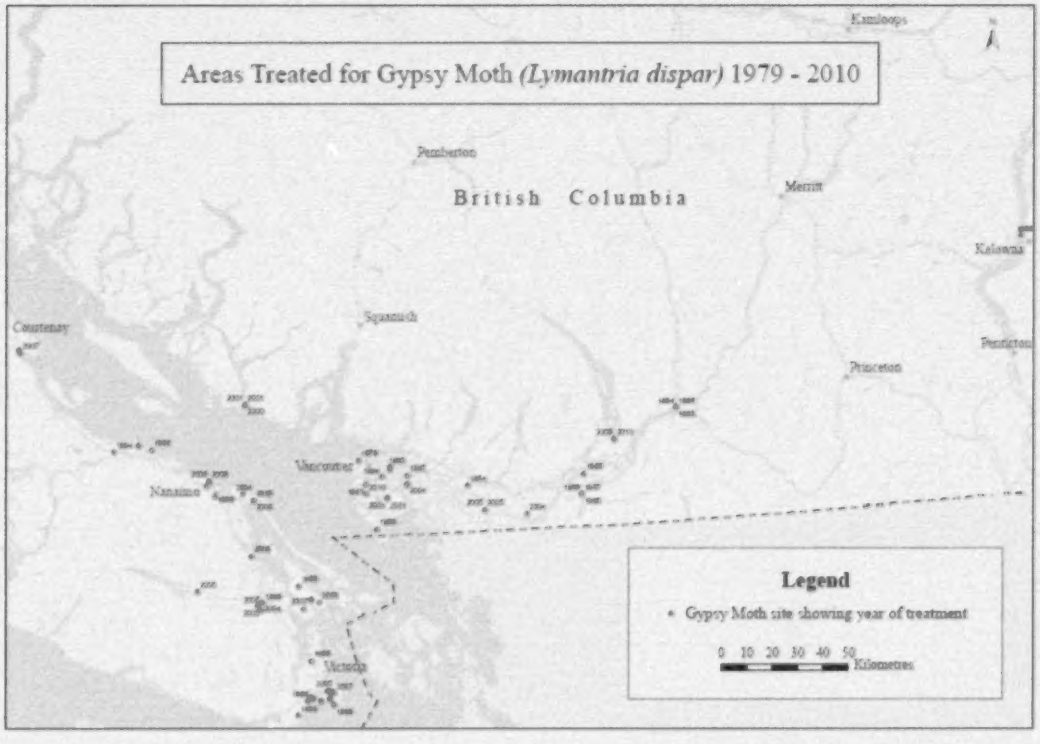

Figure 8. Gypsy Moth treatment areas 1979-2010. Note: data points are not exact and do not show the entire treatment area. See Table 7.

Table 7. Gypsy Moth Treatment History in B.C. (B.C. Ministry of Forests, Lands and Natural Resource Operations 2012).

General geographic area of Gypsy Moth treatment	Year of detection	Year of treatment	Aerial spray	Ground spray	Mass trapping	Unknown	Host removal
Kitsilano*, Vancouver (Mainland)	1978	1979		x		x	
Ft. Langley (Mainland)	1982	1984				x	
Courtenay (Vancouver Island)	1983	1984				x	
Courtenay (Vancouver Island)	1983	1985				x	
Canadian Forces Base Chilliwack (Mainland)	1983	1985		x			
Canadian Forces Base Chilliwack (Mainland)	1983	1986		x			
Canadian Forces Base Chilliwack (Mainland)	1983	1987	x				
Kelowna (Mainland)	1986	1988	x	x			
Canadian Forces Base Colwood, Vancouver Island	1986	1988	x				
North Parksville (Vancouver Island)	1987	1988		x			
Parksville (Vancouver Island)	1987	1990	x	x			
North Saanich (Vancouver Island)	1990	1991	x	x			
Belmont Park (Vancouver Island)	1990	1992	x				
South Parksville (Vancouver Island)	1991	1992		x			
Richmond (Mainland)	1991	1993	x				
Burnaby (Mainland)	1992	1993	x				
Salt Spring Island (Gulf Island)	1991	1993		x			

General geographic area of Gypsy Moth treatment	Year of detection	Year of treatment	Aerial spray	Ground spray	Mass trapping	Unknown	Host removal
Victoria (Vancouver Island)	1992	1993	x				
Hope (Mainland)	1992	1993	x				
South Vancouver (Mainland)	1991	1994		x			
Victoria (Vancouver Island)	1992	1994	x				
Beban Park, Nanaimo (Vancouver Island)	1992	1994	x				
Whiskey Creek (Vancouver Island)	1992	1994	x				
Hope (Mainland)	1992	1994	x				
Chilliwack (Mainland)	1992	1995	x	x			
Hope (Mainland)	1992	1996	x				
New Westminster (Mainland)	1995	1997					x
Victoria (Vancouver Island)	1996	1998		x			
Colwood (Vancouver Island)	1996	1998		x			
Esquimalt (Vancouver Island)	1996	1998		x			
Victoria (Vancouver Island)	1996	1999	x				
Colwood, (Vancouver Island)	1996	1999	x				
Esquimalt (Vancouver Island)	1996	1999	x				
Duncan, Vancouver Island	1998	1999	x				
Nanaimo (Vancouver Island)	1998	1999	x				
Brentwood Bay (Vancouver Island)	1998	1999	x				
Tsawwassen (Mainland)	1998	1999	x				
Metchosin (Vancouver Island)	1998	1999	x				
Burnaby (Mainland)	1999	2000	x				
Sechelt (Mainland)	1999	2000			x		
Sechelt (Mainland)	2000	2001			x		
Sechelt (Mainland)	2001	2001			x		
Delta (Mainland)	1998	2001		x			
Delta (Mainland)	1999	2001		x			
Delta (Mainland)	2000	2001		x			
North Delta (Mainland)	2001	2002			x		
Saanich (Vancouver Island)	2001	2002			x		
North Delta (Mainland)	2002	2003			x		
Saanich (Vancouver Island)	2002	2003			x		
North Delta (Mainland)	2003	2004	x		x		
Saanich (Vancouver Island)	2003	2004	x		x		
Abbotsford (Mainland)	2003	2004			x		
Duncan (Vancouver Island)	2003	2004			x		
Gabriola Island (Gulf Island)	2003	2004			x		
Duncan (Vancouver Island)	2003	2005			x		
Duncan (Vancouver Island)	2004	2005			x		
Gabriola Island (Mainland)	2003	2005			x		
Gabriola Island (Mainland)	2004	2005			x		
Saanich (Vancouver Island)	2003	2005			x		
Saanich (Vancouver Island)	2004	2005			x		
Langley (Mainland)	2003	2005			x		
Langley (Mainland)	2004	2005			x		
Nanaimo (Vancouver Island)	2003	2006					

General geographic area of Gypsy Moth treatment	Year of detection	Year of treatment	Aerial spray	Ground spray	Mass trapping	Unknown	Host removal
Nanaimo (Vancouver Island)	2004	2006					
Nanaimo (Vancouver Island)	2005	2006		x	x		
Salt Spring Island (Gulf Island)	2003	2006					
Salt Spring Island (Gulf Island)	2004	2006					
Salt Spring Island (Gulf Island)	2005	2006		x	x		
Saanich (Vancouver Island)	2003	2006					
Saanich (Vancouver Island)	2004	2006					
Saanich (Vancouver Island)	2005	2006		x			
Courtenay (Vancouver Island)	2006	2007	x				
Salt Spring Island (Gulf Island)	2006	2007	x	x	x		
Cedar Hill Golf Course (Vancouver Island)	2006	2007		x	x		
Belmont Park, Colwood (Vancouver Island)	2006	2007		x	x		
Salt Spring Island (Southern Gulf Island)	2004	2008		x			
Saltair, near Ladysmith (Vancouver Island)	2007	2008		x			
Lake Cowichan (Vancouver Island)	2007	2008			x		
Harrison (Mainland)	2009	2009	x				
Harrison (Mainland)	2010	2010		x			
Richmond (Mainland)	2010	2010	x				

* 1979 treatments did not use Btk. All remaining aerial and ground spray treatments used Btk.
Aerial spray treatments involve aerial applications using aircraft over a pre-determined spray zone. Treatments are typically applied three times on three separate dates within the larval activity period for Gypsy Moth, April and May. Ground spray treatments involve hand held hydraulic sprayers that directly spray foliage within treatment zone. Mass trapping involves a grid of pheromone baited traps within a treatment zone. Host tree removal involves removal of vegetation thought to be the prime source of the initial introduction.

Quantified, targeted search effort took place in 2007, and 2009 – 2011 (Table 2). This amounted to at least 1129 hours, at least 1660.7 km of walking transects; and 4847 km of driving (assessing habitat by slowly travelling logging roads, stopping when good habitat is observed, and completing surveys within such habitat). Additional boat surveys around Harrison and Pitt Lakes were also completed (62 km by slowly travelling along shorelines, stopping when good habitat is observed, and completing surveys in such habitat). These revealed a few new sites for the Dun Skipper (Knopp *et al.* 2010), yet there are still isolated and small bogs throughout the region (e.g. University of British Columbia Malcolm Knapp Research Forest bog habitat) that remain to be thoroughly searched (D. Knopp pers. comm. 2010). Search effort for the Dun Skipper throughout Metro Vancouver parks in the lower Fraser Valley has not yielded any records other than at Metro Vancouver Burns Bog Ecological Conservancy Area. These areas are within the current range extent and would not impact EO but would alter IAO.

Researchers, conservancies, naturalists and biologists have conducted non-quantified surveys for Dun Skippers in the past ten years, concurrent with their own areas of focus. It is not possible to accurately quantify all search effort by these individuals, but it has clearly been considerable. A summary of recent butterfly surveys within the range and potential habitat for the Dun Skipper (Vancouver Island and Gulf Islands only) is summarized in Table 3. There has been less effort on the mainland, although some occurrences of the Dun Skipper are reported (B.C. Conservation Data Centre 2012).

Surveys by local conservancy groups have recorded Dun Skipper in the past decade on the Gulf Islands, including Salt Spring Island (R. Annschild pers. comm. 2010), Denman Island (A. Fyson pers. comm. 2010), and Hornby Island (J. Miskelly 2004; J. Heron and S. Lavallee 2006) (B.C. Conservation Data Centre 2010). Conservancies such as Mayne Island (M. Dunn pers. comm. 2010) and Galiano Island (T. Crowe pers. comm. 2010) have searched unsuccessfully for the species. Further surveys coordinated by the Victoria Natural History Society in the greater Victoria area have also recorded the skipper in various areas throughout the region (J. Tatum pers. comm. 2010; J. Miskelly pers. comm. 2010; D. Copley pers. comm. 2010).

HABITAT

Habitat Requirements

The historical habitat of Dun Skippers is difficult to characterize, given the lack of information that accompanies historical museum collections (Royal B.C. Museum 2009; University of British Columbia Beaty Biodiversity Museum, Spencer Entomological Collection 2009; Canadian National Collection 2008; Shepard 2000ab). Recent surveys (Table 2) have focused on collecting habitat and biological information, yet habitat requirements are still difficult to characterize, primarily because the species' larval food in B.C. has not been confirmed.

Dun Skippers have been observed in a variety of habitat types, most of which are difficult to assign a specific ecosystem description. General habitat characteristics for the Dun Skipper include open south to southwest slope exposures (< 15% slope), adjacent to or within open forest comprised of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco). These areas often have lowland forest components below cliffs and hillsides comprised of Douglas-fir and open deciduous woods that include Bigleaf Maple (*Acer macrophyllum* Pursh), close proximity to open, sparsely vegetated cliffs (Knopp *et al.* 2007; 2009; 2010), and edges of sedge-dominated wetlands and wet grasslands (Pyle 2002). As one traverses east through the Coast Mountains (e.g. to Boston Bar, Lillooet, and Pemberton), habitats become drier, and there Dun Skippers have been observed on gently sloping hillsides, generally within 1 km of cliff habitat. In the most xeric sites (e.g. Lillooet), the sites were sheltered from wind and associated with moister Douglas-fir habitat (Knopp *et al.* 2007; 2009; 2010). (See Appendix 1 for images of Dun Skipper habitat).

Dun Skippers have also been observed within Garry Oak and associated habitats (e.g. at Somenos near Duncan, Francis King and Thetis Lake Regional Parks in Greater Victoria, and Helliwell Provincial Park on Hornby Island (Table 1) (B.C. Conservation Data Centre 2012)), although the species is not considered a specialist of these habitats.

The Dun Skipper has been recorded in disturbed sites including roadsides, railway right-of-ways, ditches, and power line right-of-ways; areas with spring floods, natural hot springs or seeps (Guppy and Shepard 2001), and stream banks; and habitats that appear dry but where spring floods likely occur and moist conditions sustain populations of potential host plants (B.C. Conservation Data Centre 2012). The Dun Skipper has also been recorded from bog habitats (e.g., Burns Bog Ecological Conservancy Area). The primary similarity among all sites where the species has been recorded is high moisture during spring and summer, which may prevent premature host plant senescence.

Larval host plants

Larval host plants, in general, are known to be sedges (*Carex* spp.) including Sun Sedge (*Carex inops* ssp. *heliophila* (Mackenzie) Crins) (Layberry *et al.* 1998; Pyle 2002), and grasses (*Poa* spp.) (Brown and McGuire 1983). Dun Skipper (eastern population) larvae are known to feed upon Yellow Nut-grass (*Cyperus esculentus* L.) (Heitzman 1965; Guppy and Shepard 2001), San Diego Sedge (*Carex spissa* Bailey) (Brown 1982; Layberry *et al.* 1998), Hairy Sedge (*Carex lacustris* (Willd.)) and Graceful Sedge (*Carex gracillima* Schwein.) (Layberry *et al.* 1998). These plants do not occur or are rare (though not introduced) in B.C. (B.C. Conservation Data Centre 2012). Various species of grasses and sedges occur throughout the province within the known range of the Dun Skipper (B.C. Conservation Data Centre 2012).

The matrix and dimensions of larval and nectar food plant habitat patch sizes, spatial boundaries, specific habitat characteristics and features necessary to sustain populations are poorly understood. Thus it may be the presence of the species' host plant(s) that determines its apparent random occupancy of a given habitat. Based on the distribution of the Dun Skipper in B.C. (Figure 3), it is unlikely a single host-plant species is used. Based on the observations of larval silk shelters (see Life History and Reproduction), it would appear that as long as the leaf type is suitable, any species of Cyperaceae or Poaceae may be adequate for larval development (Shepard 2000b).

Nectar plants

Along the Fraser River, Dun Skippers appear to favour nectar sources such as Spreading Dogbane (*Apocynum androsaemifolium* L.) (native plant) (Knopp *et al.* 2009; Knopp *et al.*, 2010) and Alfalfa (*Medicago sativa* L.) (non-native) (Knopp *et al.* 2009). They are also known to use Fireweed (*Epilobium angustifolium* L.) (native), Lotus Milkvetch (*Astragalus lotiflorus* Hook.) (native), Goldenrod (*Euthamia* spp. and *Solidago* spp.) (native), Sweet William (*Dianthus barbatus* L.) (non-native), and various species of thistles (Family Asteraceae) (both native and non-native species) (Pyle 2002). On Denman Island, a Dun Skipper was observed nectaring on an Oxeye Daisy (*Leucanthemum vulgare* Lam.) (non-native) (Guppy *et al.* 2007).

Moisture regime and successional stage

Dun Skipper habitat includes disturbed sites (e.g. roadside ditches, clear-cuts) with seasonally wet areas, partially due to the early successional stage required by the likely grass and sedge family host plants. Undisturbed habitats with more apparent natural features include wet marshy habitats with Common Rush (*Juncus effusus* L.) plants.

Habitat Trends

The Dun Skipper does not appear to have a specific obligate habitat type (see Habitat Requirements). Although habitat trend information is available for specific habitat types, it would only reflect a portion of potential Dun Skipper habitat. Habitat trends in the Fraser Canyon and Pemberton areas are not well documented. Vegetation succession and forest fire suppression are reducing habitat in those regions, but forest clearing and forest fires may be somewhat offsetting those losses. Following is an account of trends in specific habitat types within the Fraser Valley and the Vancouver Island-Gulf Islands region.

Habitat trends within the Fraser Valley

Seasonal wetland and streamside declines

Development throughout the Fraser Valley from the 1860s to present has resulted in a reduction of wetland habitat cover from approximately 10% to less than 1.5% (as of 1996) (Boyle *et al.* 1997, as cited in B.C. Ministry of Water, Land and Air Protection 2002). These wetland areas include lowland swampy and marshy land that would have been seasonally flooded (Boyle *et al.* 1997 as cited in B.C. Ministry of Water, Land and Air Protection 2002). If the loss of wetlands is used as a surrogate for natural Dun Skipper habitat, there has been an 85% decline of suitable habitat since European settlement began. Sensitive ecosystem inventory mapping of the Metro Vancouver regional area is underway but not yet available (C. Cadrin pers. comm. 2011).

Dun Skipper habitat also includes open riparian areas adjacent to streams and more permanent wetlands (see Habitat). Since European settlement, there has been extensive alteration to stream flow in the Fraser Valley. As a result, approximately 15% of streams that once existed in the Fraser Valley no longer exist and 71% are considered at risk (defined in the Fraser River Action Plan, 1998 as cited in B.C. Ministry of Water, Land and Air Protection 2002). If the loss of streams is used as a surrogate for potential natural Dun Skipper habitat, it is assumed there has been a 15% decline in streamside potential habitat since European settlement.

When comparing search effort with known Dun Skipper records, the species appears to have disappeared from the core areas of its range within the Lower Mainland (from the coast east to Chilliwack area) and only remains at the periphery of its range in the Hope area and the Fraser Canyon. The only record of the species within high quality and protected habitat is at Burns Bog Ecological Conservancy Area (Figure 4; number 20).

Habitat trends within southeastern Vancouver Island and Gulf Islands

Habitat trends within southeastern Vancouver Island follow a similar decline to those in the Fraser Valley. Agricultural and urban development, logging and infilling have impacted wetland habitats and seasonal flooding regimes and thus have likely led to an overall decline in the natural habitat available for the Dun Skipper. But there is minimal quantitative information on overall wetland habitat loss.

Potential Dun Skipper habitat in this area has been assessed by comparing aerial photographs taken from 1993-1997 with those from 2002. Habitat that has been lost or disturbed includes riparian (4.6% loss), open woodland (2.6% loss) and wetland ecosystems (2.0% loss) (Canadian Wildlife Service and B.C. Ministry of Environment 2004; Kirkby and Cake 2004).

The Dun Skipper has been recorded within Garry Oak and associated ecosystem habitat at Somenos, Hornby Island and in some dry habitats in the Victoria area and on Denman Island. Much historic Garry Oak ecosystem habitat has been destroyed or is degraded due to invasive species and other human activities. Lea (2006) mapped historic Garry Oak ecosystems, focusing on the five major geographic areas known to contain it (greater Victoria, Cowichan Valley, Comox Valley and surrounding areas, Nanaimo, Nanoose area as well as Salt Spring Island and Hornby Island). Less than ten percent of the original Garry Oak ecosystem remains on southeastern Vancouver Island (Lea 2006).

BIOLOGY

Life Cycle and Reproduction

The flight period in B.C. ranges from late May to mid-August, slightly earlier in the south, and there is one generation a year (Table 4) (B.C. Conservation Data Centre 2012; Opler and Krizek 1984; Shepard 2000ab).

Males perch approximately one metre from the ground and wait for receptive females (D. Knopp pers. comm. 2010; Guppy and Shepard 2001). Females lay eggs singly, on the underside and at the base or midway along the leaf of the host plant (Guppy and Shepard 2001; Brown and McGuire 1983; Heitzman 1965). Eggs hatch after approximately a week (Heitzman 1965), larvae begin feeding and eventually form tubular silk shelters (one larva per shelter) (Opler *et al.* 1995). Silk shelters are formed from two to four tied and rolled host plant leaves near the base of the host plant (Brown 1982; Brown and McGuire 1983; Heitzman 1965). Based on the observations of silk shelters, it would appear that as long as the leaf type is suitable, any species of Cyperaceae or Poaceae is adequate for larval development. Larvae hibernate throughout the winter months within these tubular silken shelters and emerge the following spring. Pupation occurs within the silken tubes at the base of the host plants in spring.

Based on information from other populations in North America (including Washington State), older larvae use one or more shelter sites for a total period of 24 to 36 days between late May and late August (Brown 1982; Shepard 2000ab). Larval hibernation likely occurs from September to May (Pyle 2002). The pupal stage lasts for 18 to 21 days (Pyle 2002) between April and June (Brown 1982; Shepard 2000ab; Pyle 2002).

Physiology and Adaptability

There is no information on the physiology or adaptability of the Dun Skipper in B.C. The Dun Skipper is known to exhibit host plant specificity at any one site but host plant polyphagy over the entire range (Shepard 2000ab). This suggests the adults or larvae may 'imprint' on a certain host plant (Shepard 2000ab), although further research is needed.

Dispersal and Migration

The Dun Skipper is not migratory. It is an agile flier, however; if adults are not caught on the first attempt, they immediately flee and are difficult to locate (D. Knopp pers. comm. 2010). Dispersal distances are unknown, but research on other skippers offers some clues. The Mardon Skipper, *Polites mardon* (W.H. Edwards), has an apparent maximum dispersal distance of about 1.6 km (Runquist 2004), but generally moves less than 0.8 km annually (Potter and Fleckenstein 2001). On average, Dakota Skippers, *Hesperia dacotae* (L.) moved less than 300 m over 3-7 days, and less than 200 m through unsuitable habitat (Dana 1991). Ottoe Skippers, *Hesperia ottoe* W.H. Edwards, are known to disperse a maximum of 1.78 km through unsuitable habitat, but generally moved less than 200 m (Selby 2005).

Interspecific Interactions

The Dun Skipper is not considered an essential pollinator of any one host plant or to have other crucial ecological roles such as food-web dynamics. Larval feeding likely damages food plants but does not cause plant mortality. Further field inventory and research is needed to clarify any specific mutualism, parasitism or symbiotic relationships the Dun Skipper may have with other species.

POPULATION SIZES AND TRENDS

Sampling Methods

Surveys have been carried out primarily by wandering transects through suitable habitat with the main objective to record new sightings, habitat information and sites for the species (Table 2).

Abundance

There is insufficient information to provide precise estimates of abundance in Canada and within individual populations. However, by looking at encounter rates, habitat patch size, and the size of other skipper populations, we can put some defensible upper and lower limits on overall population size.

Some (and perhaps most) populations are undoubtedly quite small, likely numbering fewer than 100 mature individuals (C. Guppy pers. comm. 2013). One could estimate that each location contains at least 50 mature individuals, giving a minimum population for Canada of approximately 1500 (50 x 30 locations). If one assumes that some populations are larger, and that there are a few more undiscovered populations, one could estimate an upper limit of 5000 (100 x 50 locations; C. Guppy pers. comm. 2013). These estimates are consistent with those for individual Dakota Skipper populations of 'tens or hundreds' (Britten and Glasford 2002). Looking at the key population break points in the COSEWIC assessment methodology, it is likely that the population exceeds 2500, but it is unlikely that it exceeds 10,000 (C. Guppy pers. comm. 2013).

There are 207 Dun Skipper observations or specimens from 1902 to 2011 (Table 1, B.C. Conservation Data Centre 2012). Most sightings are of one or two individuals (Table 1, B.C. Conservation Data Centre 2012). The four records with the largest number of individuals observed at one time are: 13 at a site near Hope (gas pipeline crossing) in 2007 (Knopp *et al.* 2007); 12 at a site near Boston Bar (Green Canyon) in 2002 (D. Knopp, personal data submitted to the B.C. Conservation Data Centre); 10 at a site near Port Alberni in 2003; and 10 at the Nanaimo River (water main right-of-way, Vancouver Island) in 2010 (Page *et al.* 2010). It appears the best area of interconnected population occurs in a 25 km stretch of habitat in the Boston Bar area (Figure 6, number 16).

Fluctuations and Trends

Natural population fluctuations for skippers are a result of numerous factors such as parasites, predators, and the previous year's weather. The species is expected to exhibit a metapopulation structure with movement among patches of habitat.

There is minimal information on fluctuations for the Dun Skipper. Dun Skippers have been observed multiple years at some sites (see Table 1, Figure 4): Morris Valley Hemlock Ski Hill Road in 2007 and confirmed in 2010 (number 22); Hope Gas Pipeline in 2002, 2007 and 2010 (number 17); Helliwell Provincial Park in 2003 and 2004 (number 21); and Nanaimo Lakes in 1988 and again in 2010 and 2011 (number 6). At Nanaimo Lakes, the site was cleared sometime between 1988 and 1995 and no Dun Skipper observations were made when the site was revisited in 1995 (C. Guppy pers. comm. 2010) yet the species was confirmed in 2010 (Page *et al.* 2010) and 2011 (J. Heron pers. data 2011).

Historically, the Dun Skipper was likely more frequent in suitable wetland and seasonally flooded habitat. Urban and agricultural development, combined with natural succession, fire suppression and infilling/draining of wetland marshy habitats (see **Threats and Limiting Factors**), has likely led to the isolation of populations and subsequent inability of butterflies to disperse and recolonize habitat patches leading to its extirpation in some suitable areas in B.C.

Of the 28 locations considered to be extant, at least three are threatened by land development within the next three years, and at least 14 are within artificially created habitats (e.g., roadside pull-outs, pipeline crossings, and recent clear-cuts) that are rapidly changing as a result of natural vegetative succession and are not expected to be present in 10 years. This reduces the number of locations likely to remain in ten years time to 11 locations or a reduction of 60%. Offsetting this trend, there is a possibility some sites may be created through logging or other anthropogenic activities.

Severe Fragmentation

Severe fragmentation is considered to exist when most individuals of a species occur in small, isolated populations that are not considered viable. In the case of the Dun Skipper, the populations on Vancouver Island and the Gulf Islands and in the lower Fraser Valley can be considered severely fragmented: they are all small (probably on the order of 50 to 100 individuals each; C. Guppy pers. comm. 2013) and isolated, and several have become extirpated in recent years. With the exception of populations around Boston Bar, the Fraser Canyon and Pemberton populations are also isolated, but some may not be as small as those along the coast. One population (number 16 in Figure 6) is perhaps large and connected enough to be considered a viable metapopulation.

In summary, not enough information is available to state definitively that the Dun Skipper is severely fragmented in British Columbia. More than half of the known populations are small, isolated and probably not viable, but not enough is known about the size and viability of the populations in the Fraser Canyon to make the assertion that "most" individuals occur in isolated small, non-viable populations.

Rescue Effect

It is difficult to assess the rescue effect for the Dun Skipper from one site to the next. Distances between known sites can be large (> 10 km), although if there are sufficient host plants and habitat it is likely the skipper disperses through these areas (e.g., Boston Bar corridor, number 16, Figure 6). The Dun Skipper may colonize new habitats including artificially created ones (e.g. ditches, fallow flooded areas) over time if the habitat is not continually disturbed or outside the species dispersal range from occupied habitat.

Washington State has not been tracking individual sites of the Dun Skipper, nor is there survey information on the species (A. Potter pers. comm. 2010). Although there is a gap in records between British Columbia and Washington State, there is similar habitat south of the international border and Dun Skipper populations may occur within these areas. Because the separation distances and habitat connectivity between US and Canadian sites are unknown, the possibility of rescue, although unlikely, is difficult to assess.

THREATS AND LIMITING FACTORS

Limiting Factors

The main limiting factors for the Dun Skipper are likely larval host plant availability and the timing of host plant senescence (Shepard 2000ab). In early spring, host plants are just beginning to grow and thus host plant phenology likely influences larval growth and survival. As natural forest succession occurs these resources diminish (see Habitat Trends and Threats).

Historic Threats

Reasons for the extirpation of the Dun Skipper from most historic locations are speculative (see Habitat Trends), but are probably related to wetland habitat loss and development.

Not all historic sites have been resurveyed due to the lack of precision of collection data (e.g. museum specimens labelled 'Victoria'). Extensive land development and habitat conversion, leading to population isolation and demographic collapse were likely the main threats to historic populations. Fire suppression leading to increased natural forest succession within open Garry oak habitats, combined with premature host plant senescence, also likely played a role in the extirpation of populations.

Current Threats

The International Union of Conservation-Conservation Measures Partnership (2006) (IUCN-CMP) threats calculator was used to classify and list threats to the Dun Skipper (Salafsky *et al.* 2008; Master *et al.* 2009). The overall Threat Impact for the Dun Skipper is High (Table 4). Major threats (highest to lowest impact) across all sites include a combination of succession (both natural forest succession and exotic species invasion), and impacts of fire and fire suppression. Threats to rural sites include agricultural land clearing. However, anthropogenic disturbance of habitat currently unsuitable for the species, such as clearing of densely vegetated ditches and roadsides, is expected to result in additional areas becoming occupied, reducing the impact of predicted threats. The use of the insecticide Btk for European Gypsy Moth control is also a current and historic threat (Figure 8 and Table 7). It would impact multiple sites making the number of locations fewer, although not all locations would be affected simultaneously. Threats that are applicable to the Dun Skipper are further discussed below under the IUCN-CMP level 1 headings and summarized in Table 5.

Residential & commercial development (IUCN – CMP Threat 1.)

The Dun Skipper is threatened by cumulative habitat loss from urban and rural land conversion, and subsequent habitat fragmentation. Core habitats affected by development in the Lower Mainland are within the jurisdictions of Abbotsford, Mission, Chilliwack, Langley, Fort Langley, and Hope. On Vancouver Island, core areas include the 13 municipalities of greater Victoria and extend up southeastern side of Vancouver Island to the Courtenay area. Most of the large habitat patches within these areas are in private ownership (either owned by the local government, or timber or development companies) and urban planning projections designate many for housing or commercial development.

Human activities associated with urban development, specifically those that alter natural hydrological patterns so that habitats become too dry or are flooded for prolonged periods, can be detrimental. Proposed urban development requires various types of permitting under local, provincial and federal government policy and legislation. The scale, scope and impact of the development determine the type of permitting. As part of the environmental planning process, a proponent is required to apply for a development permit to local government.

At present, residential and commercial development primarily threaten potential Dun Skipper habitat in Bevan, Mission, Sahtlam District, Salt Spring Island, Somenos, Wellington, Denman Island, Maple Bay, Spectacle Lake and Burns Bog.

Housing and urban areas (Threat 1.1)

Within the mainland range of the Dun Skipper, there has been a minimum of 73 separate housing developments in urban areas with Dun Skipper habitat (Abbotsford, Chilliwack, Agassiz, Maple Ridge, Mission and Langley). These urban developments include large-scale, new communities with new infrastructure, such as schools, roads, and central shopping amenities and, in some cases, golf courses and other recreational infrastructure. Most of this development has been within privately owned natural land within the Sumas Mountain and other areas of rural Abbotsford (see City of Abbotsford 2003), Vedder Mountain and other natural areas of Chilliwack, within the lower Fraser Valley (Greater Vancouver Real Estate 2011).

Dun Skipper habitat on southeastern Vancouver Island is also threatened by urban and rural land conversion, and subsequent fragmentation of the open, sparsely vegetated wetland and Garry Oak ecosystem habitat. The uncertainty surrounding land use and the frequently changing land ownership increases the potential threat of habitat conversion. Within the greater Victoria area there is a minimum of 12 large-scale, urban housing, commercial or recreational facility (e.g., golf courses) developments on natural habitat totalling greater than 1550 ha that are ongoing or planned for immediate commencement, the majority within Colwood, Langford and Central Saanich (Victoria Real Estate Team 2011). These natural areas all have potential Dun Skipper habitat (as assessed through satellite imagery). These developments include large-scale, new communities that include infrastructure such as schools and roads.

This threat applies directly to at least four biological populations, including potential habitat on Denman Island, where land is being subdivided and sold to individual landowners (i.e., the skipper has been recorded from adjacent properties other than the one being developed, but the habitat types are similar).

Commercial and industrial areas (Threat 1.2)

Industrial and business park expansion plans are published for some municipalities within the lower Fraser Valley (mainland), such as the City in the Country Plan specific to the City of Abbotsford. This plan projects the need for "1,300 acres of employment-generating industrial and business park lands over the next 20 years" with "future residential development accommodated through hillside development...not accommodated by expansion into the Agricultural Land Reserve" (City of Abbotsford 2003).

This threat also applies directly to a known Dun Skipper site and habitat on private land adjacent to the Burns Bog Ecological Conservancy Area. Burns Bog, as a habitat unit is not entirely within conservation land, and a parcel of private land has potential for commercial real estate (industrial park) development, and an ongoing highway expansion project (South Perimeter Road) is occurring at the margins of the bog.

Tourism and recreational areas (Threat 1.3)

The demand for tourism and recreational areas within southeastern Vancouver Island has increased substantially within the past decade. Natural areas continue to be developed into golf courses (e.g., Bear Mountain development [Victoria Real Estate Team 2011]), parks and recreation facilities (e.g., outside the boundaries of Goldstream Provincial Park). Within existing parks, as well as on regional and municipal properties, habitat conservation and recreational development potentially conflict with Dun Skipper conservation. On the northern edge of the Fraser Valley, this threat applies directly to the known Dun Skipper site at the Morris Valley Hemlock Ski Hill (number 22, Figure 4, Table 1, 2), where a major ski hill expansion has been proposed.

Expansion of recreational areas increases the number of roads and trails, which can act as corridors that facilitate the rapid spread of introduced species into natural habitats (e.g. plant seeds attach to car tires and become dislodged at new sites) (Trombulak and Frissell 2000).

Annual and perennial non-timber crops and livestock farming and ranching (Threat 2.1 and 2.2).

Clearing of land for agricultural is ongoing, in small amounts, on private lands throughout the range of the Dun Skipper. Land clearing on agricultural land reserves is also ongoing. Detrimental impacts to Dun Skipper habitat from livestock grazing have been recorded from habitats on Denman Island, although moderate livestock grazing may be partially beneficial. The impacts of grazing itself are unknown, but trampling of sensitive wetland areas often results when livestock congregate adjacent to watercourses.

Transportation and service corridors (Threat 4.)

Roads, railroads, utility and service lines (Threat 4.1 and 4.2).

With increasing human population comes the need for associated transportation infrastructure and access to both new and existing urban areas. Proposed transportation routes are often planned through areas that have the least impact to existing private landowners; e.g., land (frequently also natural areas) owned by the local or provincial government, land currently within the provincial Agricultural Land Reserve (although the land may be privately owned); or land through natural areas owned by one private landowner or company.

Within the geographic range of the Dun Skipper, extensive roads and other similar transportation corridors already fragment much of the remaining natural habitat. Increased roads, trails and corridors lead to further habitat modifications through the spread of introduced species (IUCN-CMP Threat 8.1) and increased frequency of use by humans (IUCN-CMP Threat 6.1). Roadsides act as corridors into natural habitats and are known to facilitate the rapid spread of introduced species (e.g., plant seeds attach to car tires, and become dislodged at new locations) (Trombulak and Frissell 2000). The potential spread of introduced species along roadsides may impact local populations through competition and predation, as well as changes to native vegetation (see IUCN-CMP Threat 8.1).

Human activity, such as ditch creation, clearing the ditch of in-water and streambank vegetation, or flushing the ditch and flooding streambank vegetation throughout the species' historic range would appear to create habitat suitable for growth of Dun Skipper's larval and nectar host plants, while concurrently destroying other habitats.

Road and utility/service line maintenance activities are applicable to many of the sites where the Dun Skipper occurs along forest service roads, such as those sites within the Chilliwack, Boston Bar, Lillooet, Lytton, Hope, Pemberton and Nanaimo areas. This threat applies to at least eight Dun Skipper biological populations (Figure 6, numbers 3, 4, 6, 16, 17, 20, 22 and 25), including a site at Burns Bog (Figure 6, Number 20), where a development and an ongoing highway expansion project (South Perimeter Road) is occurring at margins of the bog.

Biological Resource Use (Threat 5.)

Logging and wood harvesting (Threat 5.3)

In some areas, natural succession may be delayed and/or forest harvesting may create open habitat for the expansion of Dun Skipper populations. For example, the open, wet, marshy clearings and logged areas of central Denman Island have provided ideal habitat for population expansion to other areas throughout the Island. A recent provincial park has been established on Denman Island, covering approximately 75 hectares of regenerating (e.g., previously clear-cut) forest. There is a carbon covenant on this property that stipulates the property must allow the forest to grow for the use of carbon sequestration. Eventually, these large open clear-cuts will grow and habitat will once again become limited on Denman Island.

Natural forest succession has also led to an increase and then decline of Dun Skipper habitat at the Dog Mountain site. When the site was initially found in 2007, the habitat was in early successional stages dominated by Spreading Dogbane and other herbaceous vegetation. Since 2007, the roadside successional vegetation has outgrown the Spreading Dogbane and is now dominated by invading shrubby vegetation, including Himalayan blackberry (*Rubus armeniacus* Focke) and introduced White Virgin's Bower (*Clematis virginiana* L.) (Knopp *et al.* 2010).

Natural forest succession threatens other sites, such as those within the areas of Chilliwack, Boston Bar, the Gulf Islands, Lillooet, Lytton, Hope, Pemberton and Nanaimo areas. Sites on Hornby Island and Denman Island are also threatened by natural forest succession. Logging and forestry activities may also create habitat for Dun Skipper.

Human intrusions and disturbance (Threat 6.)

Recreational activities (Threat 6.1)

Recreational activities within Dun Skipper habitat include hiking (e.g., Helliwell Provincial Park on Hornby Island) and horseback riding (e.g., on Denman Island). Such activities can result in degradation of habitat quality through soil compaction and can also cause accidental mortality of larvae.

Areas with particularly high recreational use include those habitats within Metro Vancouver and Fraser Valley Regional District parks; and within the Capital Regional District. Hiking and related activities may also increase the spread of introduced species (see IUCN-CMP Threat 8). Recreational use of trails for horseback riding is also prominent and likely impacts habitat (e.g., trampling of trails/edges and defecation which increases the spread of fungus, seeds, etc.).

Natural system modifications (Threat 7.)

Fire and fire suppression (Threat 7.1)

Fire suppression is ongoing throughout the entire range of the Dun Skipper. Within Garry oak and associated habitats, fire suppression has led to further natural forest succession within these open habitats (GOERT 2010), and thus a decline in potential Dun Skipper habitats. Burns Bog periodically experiences ground fires, and although efforts are made to control blazes, fire does impact habitat. The threat of both fire and fire suppression activities is present throughout the range of the Dun Skipper, particularly within large natural tracts of land, areas adjacent to roadways and right-of-ways and in recreational areas. Human activities such as brush burning and mowing as a form of fire suppression may adversely affect Dun Skippers. Brush clearing, piling and periodic burning of vegetation and woody debris occur on private and public lands throughout its range. Mowing and cutting of vegetation within sites may impact the Dun Skipper through decreasing available moisture retention within habitats, increasing dehydration stress to individuals and direct mortality.

Invasive and other problematic species and genes (Threat 8.)

Invasive non-native/alien species (Threat 8.1)

Many of the sites where the Dun Skipper has been recorded have become degraded and/or dominated by introduced species such as agronomic grasses and weedy forbs.

Invasive plant species such as Scotch Broom (*Cytisus scoparius* L.) have the ability to fix nitrogen and are known change vegetation and soil structure (Haubensak and Parker 2004). Invasive species legacy (resulting in long-term ecosystem impacts from prolonged invasive species growth) and increasing the nitrogen availability in the soil may encourage exotic species growth in native grasslands (Huenneke *et al.* 1990; Maron and Conners 1996, as read in Rook *et al.* 2011). Scotch Broom is also associated with suppressed native species richness (Rook *et al.* 2011) and more specifically is a high threat at Vancouver Island sites, especially to the roadside right-of-ways at Nanaimo Lakes Road (P. Lilley pers. comm. 2010; J. Heron pers. comm. 2011), and portions of habitat on Denman Island that have abundant Scotch Broom (J. Heron pers. comm. 2010). Dun Skipper habitat at the Hope Gas Pipeline site is now covered by invading shrubby vegetation including Himalayan blackberry and introduced White Virgin's Bower (Knopp *et al.* 2010). Other sites with high invasive species presence include Hornby Island (Helliwell Provincial Park) with invasive Scotch Broom, and the Spectacle Lake and Goldstream areas. Overall, most sites are likely impacted by invasive species.

Introduced rabbits (Eastern Cottontail [*Sylvilagus floridanus*] and European Rabbit [*Oryctolagus cuniculus*]) may browse host plants, but herbivory is considered a minor threat.

Problematic native species (Threat 8.2)

Natural forest succession of native trees, shrubs and herbaceous vegetation will eventually decrease the size and quality of Dun Skipper habitats. Potential larval host plants and adult nectar sources require open habitat with abundant light and moisture (Pojar and McKinnon 1994) (see Habitat Requirements and Life Cycle and Reproduction). In some areas, natural succession may be delayed and/or forest harvesting may create open habitat for the expansion of Dun Skipper populations. For example, the open, wet, marshy clearings and logged areas of central Denman Island have provided ideal habitat for population expansion to other areas throughout the Island. Eventually, these large open clear-cuts will become forested and habitat will once again become limited on Denman Island. Conversely, succession has also led to an increase and then decline of Dun Skipper habitat (e.g., Figure 6, Number 16 Dog Mountain, Hope Gas Pipeline site).

Subpopulations of the Dun Skipper are likely at risk from demographic collapse, which may be exacerbated by other threats over time by natural forest succession. Within Garry Oak and associated habitats, fire suppression has led to further natural forest succession within these open habitats (GOERT 2010), and thus a decline in potential habitats. Ecological theory suggests the risk of extirpation from a single habitat patch is reduced with increasing numbers of surrounding subpopulations (Hanski 1982). Like other species confined to patchy habitats, populations of Dun Skipper are isolated and as natural forest succession continues in surrounding habitats, those populations will become more isolated and fragmented (see habitat loss, degradation and fragmentation). In some areas, natural succession may be delayed and/or forest harvesting may create open habitat for the expansion of Dun Skipper populations.

Natural vegetation and forest succession has the potential to impact all known Dun Skipper sites.

Pollution (Threat 9.)

Agricultural and forestry effluents (Threat 9.3)

The Dun Skipper is within the potential introduction range of European Gypsy Moth (*Lymantria dispar* L.), and traps to detect introductions of this moth are scattered throughout southern B.C. (B.C. Ministry of Forests, Range and Natural Resource Operations 2012). Should Gypsy Moths be found in significant numbers, ground and aerial spray of Btk (*Bacillus thuringiensis* kurstaki) are applied to control the moth. Btk is a component of commercial pesticides that use spores of a naturally occurring pathogenic bacterium to control defoliating caterpillars, although the bacterium also affects most non-target butterfly and moth larvae.

The area of Btk application varies yearly and depends on the extent to which Gypsy Moths are trapped during previous year surveys. Gypsy Moth treatment areas since 1979 are shown in Figure 8 and Table 7, and the cumulative impacts of this spray program may have contributed to extirpation at some historic sites. Since trap results are compiled over at least two years, should Gypsy Moth be recorded there would likely be time to seek treatment options rather than simply broadcast aerial sprays. It is unlikely the entire Dun Skipper range would be treated for Gypsy Moth.

According to October 2011 trap results, no treatment is planned for 2012. (J. Burleigh pers. comm. 2012). Areas throughout the Dun Skipper's range do occur along prominent points of potential entry for the Gypsy Moth. Btk for Gypsy Moth is typically applied in early April to early May, which coincides with Dun Skipper larval activity. It is unlikely the entire range would be eradicated, although it could be significantly impacted.

Additional agricultural and forestry effluents most likely to cause harm to Dun Skipper habitat and individuals are herbicides used to control vegetation. The general use of herbicides to control regeneration of vegetation adjacent to roadsides and right-of-ways on commercial forestry lands may also impact skipper populations. Herbicides are used less today; however, it is unclear how extensive this practice was (or is) within the range of the Dun Skipper.

Geological events (Threat 10.)

Earthquakes/tsunamis (Threat 10.2)

Some Dun Skipper sites are within the potential flood zone should an earthquake or tsunami occur; specifically Burns Bog Ecological Conservancy Area (Number 20 on Figure 6), lowland areas of the Fraser Valley and parts of the greater Victoria area.

Climate change and severe weather (Threat 11.)

Habitat shifting and alteration, droughts, storms and flooding (Threat 11.1, 11.2, 11.4)

Climate change is a potential threat to the Dun Skipper; primarily due to the impacts such change brings to the wetland ecosystems and plant communities within which the species lives. Increased summer droughts may affect habitat within Dun Skipper sites by decreasing the available site moisture that allows for suitable host plant growth. By 2050, mean annual temperatures are expected to rise approximately 2 to 3°C (Hebda 1997). Within the Pacific Maritime Ecozone (where the Dun Skipper occurs in western Canada), mean temperatures increased by 1.71°C from 1960 to 2006 (Coristine and Kerr 2011). Conversely, there is an anticipated increase in winter precipitation projected for coastal areas such as east Vancouver Island.

A recent analysis of global observations from 1925 to 1999 showed that precipitation increased by 6.2 mm per decade in the latitudinal band of 50 to 70 °N, which includes almost all of British Columbia (Zhang *et al.* 2007). More specifically, on southeastern Vancouver Island the projected change in precipitation by the middle of the 21st century (2041 – 2071), relative to historical records (1961–1990), is a 10-25% increase in winter (December, January, February) and a 0 – 10% increase in summer (June, July, August) (British Columbia Ministry of Environment 2007).

PROTECTION, STATUS, AND RANKS

Legal Protection and Status

The Dun Skipper is protected under the federal *Species at Risk Act* (SARA), which provides immediate protection for individuals and their residences and includes provisions for the protection of critical habitat once identified in a recovery strategy. The Dun Skipper was included on Schedule 1 of SARA as *Threatened* in 2003 when the Act was proclaimed. It was last assessed by COSEWIC as Threatened in 2000 (Shepard 2000ab). A residence description for the Dun Skipper has not been posted on the SARA Public Registry. Similarly, a finalized recovery strategy has not yet been posted on SARA, and hence critical habitat has not yet been defined.

The B.C. *Park Act* protects invertebrate species at risk in provincial parks and protected areas. When species at risk and the habitats they require are known to occur within a protected area, provisions for management are incorporated into the park master plan (e.g. Helliwell Provincial Park). Further, the B.C. *Ecological Reserves Act* provides protection for species occurring within ecological reserves in B.C. Both federal lands managers and staff (K. Fort pers. comm. 2003 – 2009) and provincial parks staff (B. Woodhouse pers. comm. 2003 – 2007; D. Chapman, pers. comm. 2008 – 2010; S. Pratt pers. comm. 2007 – 2010) within the range of the Dun Skipper are aware of this species and advise their staff to look out for possible new occurrences.

The Dun Skipper is recommended for listing as *Identified Wildlife* under the *B.C. Forest and Range Practices Act*. Once listed under this act, it will be possible to protect known sites and habitat for this species within Wildlife Habitat Areas on provincial Crown land.

Invertebrates assessed by COSEWIC as Threatened, Endangered or Extirpated will be protected through the British Columbia *Wildlife Act* and *Wildlife Amendment Act* once the regulations listing these species are completed.

Non-Legal Status and Ranks

The Dun Skipper has a conservation status rank of S3 (Vulnerable) in B.C. (B.C. Conservation Data Centre 2012) and is nationally listed (Canada) as N2N3 (Imperiled to Vulnerable; NatureServe 2011). The global conservation status rank is G5T4 (species Secure, subspecies Apparently Secure; NatureServe 2011). In Washington State the species has a conservation status rank of S3 (NatureServe 2011). The Dun Skipper (western subspecies) has not been assigned a conservation status rank in other states where it has been recorded (NatureServe 2011).

The Dun Skipper is a priority one species (highest priority) under goal three (maintain the diversity of native species and ecosystems) of the B.C. Conservation Framework (see www.env.gov.bc.ca/conservationframework/).

Non-government conservation organizations, such as Conservancy Hornby (T. Law pers. comm. 2005 - 2009), Denman Conservancy (J. Thornton pers. comm. 2009; A. Fyson, pers. comm. 2010), Salt Spring Conservancy (R. Annschild pers. comm. 2010), Mayne Island Conservancy (M. Dunn pers. comm. 2010) and Galiano Conservancy (T. Crowe pers. comm. 2010) work with private landowners toward protecting butterfly habitat on private lands within these islands.

Habitat Protection and Ownership

Habitat protection for the Dun Skipper is challenging, primarily because the species is not associated with a specific plant community. In addition, the lack of knowledge on the host plant and the cryptic nature of the skipper further add difficulty to the identification and protection of the Dun Skipper and its associated habitat. See Table 1 for land ownership.

Federal land

The Dun Skipper has been recorded from two federal Indian Reserves: Sho-ook IR 5 and Soowahlie IR 14.

Provincial Crown forest land and unprotected land

There are 14 Crown land sites where Dun Skippers occur on land managed under the provincial forestry land base (Table 1). Prior to the sale of Crown land, environmental assessments are needed to determine if species at risk are present on the property. This assessment process applies to site number 22, Morris Valley Ski Hill Road (Figure 4), which is unprotected Crown land subject to ski hill development (see Threats), but does not necessarily protect the habitat.

Provincial parks and protected areas

Dun Skipper records in provincial parks include Helliwell Provincial Park (Hornby Island, 2004), Somenos Ecological Reserve (1976) and Burgoyne Bay Provincial Park (2008 and 2009) (B.C. Conservation Data Centre 2012). Because of vague site information attached to museum specimens, the species' presence in Goldstream and Spectacle Lake Provincial Parks is unconfirmed. Park managers and staff are aware of the skipper and its habitat needs at Helliwell Provincial Park (D. Chapman pers. comm. 2010) and Burgoyne Bay Provincial Park (C. Retzer Miller pers. comm. 2010; R. Annschild pers. comm. 2010).

Regional and municipal government owned lands

Regional and municipal government land is considered private land in B.C. The Dun Skipper has been collected from Francis-King Regional Park (1962) and Thetis Lake Regional Park (both Capital Regional District parks, and collected in 1962 and 1963 respectively), and recorded from Burns Bog Ecological Conservancy Area (Metro Vancouver park, observed in 2004) (B.C. Conservation Data Centre 2012). Where Dun Skipper sites are within regional or municipally owned land, these governments are aware of the species (M. Merkens pers. comm. 2005 – 2010 [Metro Vancouver]; M. Fuchs pers. com. 2003 – 2010 [Capital Regional District]).

Private conservation land

Conservation covenants on Denman Island that contain habitat where the Dun Skipper has been observed include Central Park (59.5 ha) and property owned by the Denman Conservancy named "Settlement Lands" (160 ha) (A. Fyson pers. comm. 2010; Denman Conservancy Association 2010).

Private property and private forest land

Much potential habitat is privately owned by individual landowners (e.g. farms or rural properties), private forest companies (e.g. for timber production) or within local government ownership. Surveys on private forestland recorded a few new records on southern Vancouver Island (Page *et al,* 2010) and along the Fraser River (Knopp *et al.* 2007, 2009, 2010).

Many private properties on the Gulf Islands contain potential habitat for Dun Skippers and the Denman Conservancy, Galiano Conservancy, Conservancy Hornby, Salt Spring Conservancy and Mayne Island Conservancy are active and effective at engaging landowners to look for the skipper on their properties.

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Jennifer Heron is the provincial invertebrate specialist with the B.C. Ministry of Environment. She directs and manages the provincial approach to invertebrate conservation, including the development and implementation of provincial legislation, policy, procedures, and standards for the conservation, and recovery of invertebrate species at risk, their habitats and ecosystems, and to keep these species from becoming at risk. She works with other invertebrate specialists to develop recovery-planning approaches and assign conservation status ranks to invertebrate groups. She works with local conservation and stewardship groups to achieve common public outreach goals.

COLLECTIONS EXAMINED

- Shepard, 2000ab for records in museums outside of British Columbia (previous status report).
- Royal British Columbia Museum, Victoria, B.C. (Claudia Copley, Collections Manager, pers. comm. 2010)
- University of British Columbia, Beaty Biodiversity Museum, Spencer Entomological Collection (Karen Needham, Collections Manager, pers. comm. 2010).

Appendix 1.

Dun Skipper habitat west of Morris Lake, at Morris Valley Ski Hill Road (Table 1). Two Dun Skippers observed July 7, 2010 (previously visited in 2007). Photograph by Denis Knopp.

Dun Skipper habitat at the Gas Pipeline right-of-way, near Hope. Seven Dun Skipper adults observed July 7, 2010. Early successional habitat dominated by nectar source, Spreading Dogbane (*Apocynum androsaemifolium L.*) in 2007. Since 2007, the roadside successional vegetation has outgrown Spreading Dogbane and site is now covered by invading Himalayan Blackberry (*Rubus discolor*) and White Virgin's Bower (*Clematis virginiana* L.) (Knopp *et al.* 2010). Photograph by Denis Knopp.

Habitat south of the town of D'Arcy, at a ditched right-of way on the Blackwater Lake Road, with grassy patches and exposed gravel. One female Dun Skipper observed July 22, 2009 nectaring on Alfalfa. Alfalfa lined the road edge interspersed with Dogbane, Douglas-fir and scattered Ponderosa Pine. The presence of a gravel pit and exposed rocky slopes surrounding the site may contribute to dry, warm conditions (Knopp *et al.* 2009). Photograph by Denis Knopp.

Pemberton Meadows, west of town of Pemberton on the Upper Lillooet Forest Service Road. Habitat included floodplain forest with a strip of nectar plants along the roadside, a large wetland to the south, and hillside/bluffs (~80% slope) with continuous Douglas-fir forest to the north. One female Dun skipper July 24, 2009 nectaring on Alfalfa Photograph by Denis Knopp.

Powerline right-of-way between the Nanaimo River and Nanaimo River Road, on the north side of river (July 22, 2010). One Dun Skipper individual perched briefly on Thimbleberry (*Rubus parviflorus* Nutt.) beside willow (*Salix* spp.) thicket along small stream beneath transmission powerlines. Small numbers of sedge plants were found along stream. This site is also the previous record labelled "Nanaimo River" (Table 1). Areas under the powerline have been cleared and resemble a regenerating clear-cut. Photograph by Patrick Lilley.

Powerline right-of-way between the Nanaimo River and Nanaimo River Road, on the north side of river (July 22, 2010). One Dun Skipper individual perched briefly on Thimbleberry beside willow thicket along a small stream beneath powerlines. Small numbers of sedge plants were found along stream. This site is also the previous record labelled "Nanaimo River" (Table 1). Areas under the powerline have been cleared and resemble a regenerating clear-cut. Photograph by Patrick Lilley.

Grassy shoulder/water main right-of-way along the Nanaimo River Road (July 21, 2010). Seven Dun Skippers were observed nectaring on patch of Spreading Dogbane along grassy road shoulder. Photograph by Patrick Lilley.

Grassy shoulder/water main right-of-way along Nanaimo River Road (July 21, 2010). Seven Dun Skippers observed nectaring on patch of Spreading Dogbane along grassy road shoulder. Photograph by Patrick Lilley.

Water main right-of-way between Nanaimo River and Nanaimo River Road, on north side of river (July 22, 2010). Ten Dun Skippers observed nectaring on large patch of Spreading Dogbane growing over the rocky area of right-of-way. Photograph by Patrick Lilley.

Water main right-of-way between the Nanaimo River and Nanaimo River Road, on north side of river (July 22, 2010). Ten Dun Skippers observed nectaring on large patch of1 Spreading Dogbane growing over the rocky area of right-of-way. Photograph by Patrick Lilley.